Andhra Pradesh Children and Parents Study (APCAPs) 4th follow up: Manual

Version 4

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Contents

Overview of the study

Synopsis:

The Andhra Pradesh Children and Parents Study (APCAPs) is a prospective inter-generational cohort in 29 urbanising villages in Ranga Reddy district, Telangana, India (N=7,693). Cohort members have been followed-up 1 to 3 times between 2003-2012. This study aims to follow up the older generation (aged 45+ at follow-up) of the APCAPS cohort and collect data on a range of chronic health conditions and outcomes, expanding the focus from cardio-metabolic disease to age-related conditions and multimorbidity.

Goal:

To estimate the prevalence and incidence of multimorbidity in the APCAPS cohort (defined as 2+ chronic conditions), identify prevalent clusters of multimorbidity, and examine the outcomes of multimorbidity.

Setting:

APCAPs is a prospective inter-generational cohort that has been incrementally built through long-term follow-up of the Hyderabad Nutrition Trial (1987-90) conducted in 29 villages (Ranga Reddy district) in the south Indian state of Telangana. The trial evaluated a programme that provided daily protein-calorie food supplements to pregnant women and children under 6 years in 15 intervention villages, with 14 nearby villages serving as controls. Situated only 50-100 km from the state capital Hyderabad, the physical and social environment of the villages is now changing, presenting a mix of rural and urban risk factors. The children (hereby "index children") born during this trial have been followed up at age 13-17 (1st follow-up; 2003-05; N=1,165), 19-24 (2nd follow-up; 2009-10; N=1,446), and 21-25 (3rd follow-up; 2010-12). At the 3rd follow-up, the siblings and parents of the index children were also invited to participate (total N=6,994). Each follow-up collected chronic disease outcome and risk-factor data (particularly focusing on cardio-metabolic disease) and collected and banked blood and DNA samples.

Sample:

The inclusion criterion for participation is prior participation in an APCAPS follow-up, residing in the local area (including non-study villages), and being age 45-plus years at follow-up. We predict an 80% follow-up which translates approximately to an expected sample size of N=2,100 participants aged 45-plus (58% women), predicted mean age 63 and 57 years for men and women respectively. Given the

intergenerational nature of the cohort, if cohort members aged under 45 attend clinics with their older relatives they will be permitted to participate in the study.

Study plan:

The study was conducted in two phases. The first phase involved tracking of APCAPS cohort members in the local area to estimate potential sample sizes and inform members of the upcoming study (2020-2021). The second phase involved clinical examinations and questionnaire data collection with participating cohort members (2022-2023). Data collection will be undertaken at the National Institution of Nutrition, Hyderabad, in a central location in each of the study villages, or at participant's households (if necessary).

Examinations:

All participants will undergo a questionnaire to record information on sociodemographics, chronic disease diagnosis and treatment, symptom-based screening tools for chronic conditions, behavioural risk-factors (diet, physical activity, psychosocial outcomes, healthcare use, reproductive history (women), Covid-19 history, and disability. They will also undergo a clinical examination which includes anthropometric measures, blood pressure, pulse wave analysis, physical functioning, grip strength, assessment of cardiac function and coronary disease risk, liver fibrosis, neuropathy, diabetic ulceration, retinopathy, peripheral arterial disease, vision and hearing impairment, and goitre (table 1). Traditional measurement tools (e.g., questionnaires to measure physical activity) will be supplemented with digital methods (e.g., accelerometers). Fasting blood and urine samples will be collected in the week following the clinical examination.

Timetable:

Participant tracking was conducted between April – August 2021 and questionnaire and protocol piloting between August - September 2021. Clinics, blood and urine collection were commenced in October 2021 and aimed to be completed in October 2022.

Source of funding:

The study is funded by the Medical Research Council, UK, and co-ordinated jointly by the National Institute of Nutrition, India, the London School of Hygiene & Tropical Medicine, UK, and the Indian Institute of Public Health, Hyderabad, India.

Table 1: Main measures and study instruments

Outcome	Instrument/method	Comments	Sample
Diet & physical activity			
Diet	Food frequency quest. (single recording)	Recall over last year	Total
Physical activity	Activity frequency quest. (single recording) Wearable devices (accelerometer (Actigraph) and smart watch (Mi-band)).	Recall over last week Worn for ~48 hours	Total Random sub-sample
Anthropometry			
Standing height	Portable stadiometer (two readings)	Seca height measure; at end expiration	Total
Body composition and weight	TANITA BC418 M57NA (two readings)	Body fat ratio, fat mass, fat-free mass, total body water, BMR and segmental body composition, weight	Total
Body shape - photos	Tablet camera (three photos)	Full body, clothed, front, side, back angle	Total
Waist circumference	ADE Metallic tape (two readings)	Narrowest part of waist observed from the front	Total
Hip circumference	ADE Metallic tape (two readings)	Maximum extension of the buttock observed from the side	Total

Grip Strength	Lafayette Hand-held Dynamometer 78010 (two readings)	Right and left arm separately	Total
Cardiovascular physiology			
Brachial blood pressure	Uscom BP+; systolic & diastolic (three readings) Omron HEM-7121; systolic & diastolic (three readings)	Sitting, right upper arm; small/normal/large cuffs	Total
Pulse rate	Uscom BP+; Beats per minute (three readings) Omron HEM-7121; Beats per minute (three readings) Smart watch (Mi-band 6)	Sitting, right upper arm; small/normal/large cuffs Worn for ~48 hours	Total Total Random sub-sample
Carotid Intima Media Thickness (CIMT) (bilateral)	Ultrasound (Philips CX-50), linear probe	Supine measures taken of carotid artery	Total
Augmentation Index	Uscom BP+ (three readings)	Sitting ,right upper arm; small/normal/large cuffs	Total
Pulse Wave	Uscom BP+ (three readings)	Sitting, right upper arm; small/normal/large cuffs	Total
ECG	12 lead 12 channel Cardiax ECG	Supine position	Ages 40+
Left ventricular function	2D echocardiogram (Philips CX-50)		Ages 40+

Room temperature	Digital thermometer (single reading taken prior to blood pressure measurement)	Thermo hygro clock J412CTH (Vector technologies)	Total
Biochemistry			
Haemoglobin	Non-cyanide method	Done at NIN; Auto-analyser; ABX Micros 60 – HORIBA	Total
Fasting sugar	GOD-POD method	Done at NIN; Randox laboratories, India Pvt Ltd	Total
HbA1c	To be confirmed		
Serum lipids (HDL, TC, Trig)	To be confirmed		
Liver function tests (ALT, AST, ALP Bilirubin)	To be confirmed		
Serum creatinine	To be confirmed		
Additional conditions			
Prior clinical diagnosis of long-term conditions	Questions designed for study	Hypertension, diabetes, diabetes complications, heart disease, asthma, tuberculosis, chronic liver disease, chronic kidney disease, thyroid problem, peptic ulcer, gastro-oesophageal reflux disease (GORD), cancer, vision or hearing impairments	Total
Prior clinical diagnosis of long-term conditions	Questions designed for study	Stroke, arthritis	Ages 45-plus
Liver fibrosis	Ultrasound (convex probe)		Total

Diabetic neuropathy	Modified Toronto Clinical Neuropathy Score	Neuropathic symptoms (6-items) and sensory examination	Participants with prediabetes and diabetes
Diabetic ulceration	Infrared photograph of the foot	CAT-S61 smart phone with infrared camera	Participants with prediabetes and diabetes
Retinal vascular examination	Bosch digital fundus camera (non-mydriatic)	Centred on the optic nerve and macula taken in a darkened room without dilation	Total
Peripheral arterial disease	Toe Brachial Index; vicorder (two readings) WHO Rose questionnaire	 4 items (+ 7 follow-up items)	Ages 40-plus Participants with TBI ≤ 0.7
Hypothyroidism	Zulewski's clinical symptoms score	6 items	Total
Goitre	Signs as assessed by fieldworker (WHO classification)	2 signs	Total
Depression	PHQ-9	9 items; 2-weeks reference period	Total
Anxiety	GAD-7	7 items; 2-weeks reference period	Total
Alcohol use disorder	Alcohol Use Disorders Identification Test	4 items (+ 6 follow-up items); 1-year reference period	Total

Angina	WHO Rose Angina questionnaire	1 item (+ 6 follow-up items)	Total
Stroke	NIMHANS survey questionnaire	4 items	Aged 45-plus (excluding those with clinical diagnosis of stroke)
Chronic obstructive pulmonary disease (COPD)	Lung Function Questionnaire	3 items	Aged 45-plus
Asthma	European Community Respiratory Health Survey (short) symptom-based questionnaire	7 items (+ 6 follow-up items), 1-year reference period	Total (excluding those with current clinical diagnosis of asthma)
Lung function	Breath recording	5 regular breaths, microphone (Boya BYM1 Omnidirectional Lavalier Condenser) held to throat.	Total
Arthritis	WHS symptom-based questionnaire	1-items (+ 3 follow-up items), 1-year reference period	Aged 45-plus (excluding those with clinical diagnosis of arthritis)
Sarcopenia	Muscle mass (TANITA BC418 M57NA) Muscle strength (grip strength)	Appendicular skeletal muscle mass Right and left arm separately	Total Total

	Physical performance (6-m timed walk)	Two 6-m walks at normal speed	Aged 45-plus
Tuberculosis	Symptom-based screening and referral for testing	5-items; Government of India's case definition of presumptive TB and night sweats	Total
Dental health	LASI survey questionnaire Mouth photograph (one)	2-items Using cheek retractor	Total Total
Gastro-oesophageal reflux disease (GORD)	Indian Society of Gastroenterology survey questionnaire	2-items (+ 4 follow-up items)	Total (excluding those with clinical diagnosis of GORD)
History of COVID-19 symptoms and test results	Questions designed for study (WHO case definitions)	7-items (+ 167 follow-up items), reference period January 2020 onwards	Total
Chronic pain	UK Biobank Chronic Pain survey	3-items	Total
Impact measures			
Health-related quality of life	EQ-5D-5L Health-Related Quality of Life Questionnaire	6-items	Total
Functioning and impairments			
Functioning	6-m timed walk Washington Group Short Set on Functioning	Two walks at normal speed 6-items	Ages 45-plus Total

Gait	Video recording of 6-m timed walk Accelerometer	Tablet set up on 1.3m tripod ~5m from central point of walk. Waist-worn accelerometer attached during 6-m timed walk.	Total Total
Vision impairment	Tumbling E LogMAR chart (4m and 40cm distance); Precision Vision	Near and distance vision; right and left eye	Ages 45-plus
Hearing impairment	Hearing Test app[1] (Hearing threshold test)	Phone-based pure-tone audiometry; right and left ear	Ages 45-plus
Healthcare			
Healthcare utilisation	LASI survey	Inpatient care; 1-item (+ 4 follow-up items); 1-year reference period Outpatient care; 1-item (+ 4 follow-up items); 1-year reference period	Total
Medication use	Questions designed for study	Medicine use; 1-item per diagnosed condition (+1 follow-up item) Regular (weekly) vitamin/ mineral supplement use; 1 item (+1 follow-up item)	Total
	Medicine name	Medicines brought to clinic	Total
Medication expenditure	LASI	1-item; 1-year reference period	Total
Age-related measures			

[1] https://www.e-audiologia.pl/HearingTest/

Cognition	Brief Community Screening Instrument for Dementia (CSI-D) Verbal fluency	Cognitive questionnaire; 9-items Informant questionnaire; 6-items Animal naming task; 1 minute	Ages 45-plus Carer/close contact of main respondent with CSI-D score ≤7 Ages 45-plus
Frailty (Fried's phenotype: slowness, exhaustion, weight loss, physical activity, weakness)	Slowness – timed walk (6-m course) Exhaustion – question on tiredness in PHQ-9 Weight loss – question developed for study (TB symptoms) Physical activity – (as above) Weakness – Hand-grip strength (as above)	Two walks at normal speed 1-item 1-item Recall over last year	Ages 45-plus Total Total Total Total
Falls	Question designed for study (Prevention of Falls Network Europe consensus group definition)	1-item	Ages 45-plus
Voice	Audio-recordings	Long held vowel sound ('a'); 5s Free speech task; 20s	Total Total

		Animal naming task; 1 minute	Ages 45-plus
Facial ageing	One facial photograph	Longitudinal Study of Aging Danish Twins protocol; passport style photo	Total
Cataracts	SAGE symptom-based questionnaire	2 items, 1-year reference period	Ages 45-plus (excluding those with clinical diagnosis of cataracts)
Psychosocial			
Stress	Perceived stress scale (short version)	4 items; 1-month reference period	Total
SAGE – Study on Global Ageing and Adult Health, WHO – World Health Organisation, WHS – World Health Survey, LASI – Longitudinal Ageing Survey India, BKPAI – Building a Knowledge Base on Population Ageing India, NHIS - US National Health Interview Survey, NIMHANS – National Institute of Mental Health and Neuroscience			

Study staff and their responsibilities

The team will consist of one project manager, one medical officer and 10 fieldworkers, and 2 clinic helpers. On each day of data collection, one staff member will be designated team leader and will have responsibility for overseeing recruitment, data collection and participant reimbursement.

Study manager

- Overall responsibility for the performance of the team, day-to-day management of field work and teams and coordinating smooth functioning of all components of fieldwork
- Deliver recruitment targets
- Primarily responsible for establishing contact with the Village leaders/Panchayat officials, securing permissions as appropriate and earmarking clinic site towards end of work in previous site. This should allow smooth moving over of the team from site to site without loss of time between villages.
- Assist with training of staff
- Ensure data quality and completeness
- Coordinate day-to-day running of the study (plan activities of other staff, surveys, and clinics)
- Supervise data entry, data back-up, data storage (electronic and paper), data validation and verification
- Supervise record keeping
- Procure equipment and consumables on time, and ensure their maintenance
- Contribute to questionnaire completion and anthropometry measurement
- Develop links with the village leaders and Anganwadi staff
- Report to the PIs at NIN and LSHTM
- Ensure daily calibration of equipment and appropriate measures
- Ensure data quality, completeness and accuracy
- Responsible for checking all equipment are in working condition and take suitable action when required
- Keep an inventory of all consumables and procure all requisite material on time.

Medical officer (x1)

- Accompany the field team to the village clinics
- Communicate results of medical examination, offer advice to the participants and refer to relevant local healthcare facilities

- Manage any medical emergencies or referrals that may be required
- Overall assistance in field clinic for other measurements.

Field staff (x10)

- Arrange appointments for participants
- Explain nature of study to participants
- Provide information sheets to participants and take consent
- Send reminders to participants
- Organise clinics, maintain equipment and records
- Involved in all aspects of the fieldwork including questionnaire completion and clinical examination
- Report to the Team Leader
- Along with the field manager and village helper, will be responsible for household visits and motivation of subjects to attend the clinics.

Clinic helpers (x2)

- Set up clinics, instruments and organise the flow of participants and arrange refreshments
- Help and support the activities of the team.

Outline of plan for fieldwork

Participant tracking

Overview:

In the months preceding the start of data collection, the field team will track previous participants. They will also use this opportunity to update their contact details, establish their status (i.e., available in the same household, migrated within the villages/local area/outside of the local area, deceased), establish rapport, and inform them of the upcoming study. All individuals that previously participated in an APCAPS follow-up (1-3) will be tracked and those aged 45-plus will be invited to participate.

Protocol:

1. A list of names and addresses of the study subjects in each village will be prepared by the study manager. Appropriate labels containing the Historical ID (Family ID) and village ID will be placed on the tracking form.
2. The field staff will visit each eligible subject's household in the designated village and record information about them in the tracking record (appendix 1). This includes the names, addresses, current status (dead, alive, moved (location)). They will also use this opportunity to explain to them the nature and purpose of the upcoming study and that clinics in the village will be carried out in the near future.
3. Fieldworkers will continue down the list until everyone in the village who is eligible has been visited, and has either (a) been contacted, (b) refused participation or (c) been categorised as non-contactable. If the subject has moved households within the 29 villages, the field team will attempt to track them down and note their new residence and contact details.
4. The information collected from this exercise will be entered into a spreadsheet and a weekly count of villages covered with number of households and status sheet of participants available in each household will be prepared.
5. This information will then be used to generate a participant list for the current study.
6. Table 2 summarises the results of the tracking exercise.

Table 2: Results of tracking exercise

Age (at tracking)	**Residing within APCAPS villages**	**Residing within local area**	**Total recruitment target (residing in APCAPS**	**Migrated outside of local area**	**Deceased**	**Not tracked/ refused to participate**

			villages/ local area)			
<45	2900	1243	4143	76	102	104
45+	2485	86	2571	2	350	33
All*	5388	1330	6718	78	455	138
* Discrepancies in totals due to missing age data						

Inclusion and exclusion criteria

- Inclusion:
    - Participation in prior APCAPS follow-up (this does not include those who have participated in other studies nested within the APCAPS villages, for instance the household survey in 2012 which covered all households in the 29 villages)
    - Residing in study villages or local area
    - Consenting to participate
- Exclusion
    - Current cases of Covid-19 (see below Covid-19 safety protocol)
    - Children (aged under-18)

While our goal is to recruit cohort members aged 45-plus, the intergenerational and ongoing nature of the cohort may mean younger cohort members attend the study clinics with their older relatives and wish to participate. All APCAPS cohort members will be permitted to participate, however participants aged under 45 will undergo a shortened protocol (see table 1 for details).

Inclusion criteria for separate measures:

- Pregnant women and individual with a prior clinical diagnosis of diabetes will not be expected to fast overnight for the blood collection but are eligible to participate in the rest of the protocol.
- Individuals with mobility issues/frailty will not be expected to participate in the physical functioning tests if they/the fieldworker deem it to be unsafe but are eligible to participate in the rest of the protocol.
- Individuals with structural limb/spine deformities will be excluded from the anthropometry protocol but are eligible to participate in the rest of the protocol.

Clinic: questionnaire and clinical examination

Overview:

Once all eligible participants have been contacted (or have been confirmed to be uncontactable), the clinic-based data collection will begin.

Recruitment strategy

Data collection will be conducted in two rounds. The first round will be conducted in the National Institute of Nutrition, Hyderabad. All transport for participants will be organised by the study team and refreshments provided throughout the day. The second round will be conducted in a central location in each of the study villages. If participants wish to participate but are unable to travel to the clinic site, data collection will be undertaken at the household. Participants will choose which site they prefer to attend.

Preparation for recruitment:

- A recruitment pack will be prepared for all eligible participants either residing within the APCAPS villages or the local area, containing:
    - Labels with the participant's name, ID number, household ID, gender, and age
    - Information sheet (appendix 3)
    - Consent form (appendix 4)
- The study manager will plan the order of data collection in the villages. Data collection will occur alternately between intervention and control villages to avoid any seasonal differences in timing of data collection between the two groups.
- A meeting will be conducted with the Village head / Panchayat leader to establish rapport, request approval to undertake data collection and request permission to conduct the clinic at the Panchayat office premises/village school/ other appropriate central site in the village. Once this is confirmed, recruitment to the daily clinics will begin.
- An attempt will also be made to enlist support of an individual in the village and local helper in mobilising support for the study. Where appropriate, help will be sought from one of the subjects in the village to garner support and enthusiasm for participation from his/her own and other families.

Protocol for recruiting participants to the clinic:

- Using the updated participant list and contact details, the fieldworkers will revisit eligible participants living in the study villages in the days preceding the clinic to invite them on the specified date, time, and location. The numbers invited per day will be planned by the study manager based on progress in recruitment in the village and round of data collection.
- If an eligible individual has moved out of the study villages but within the local area, they will be invited at the same time as their family/prior household members. These families will be invited to the clinic on weekend days to increase the probability of those outside the villages attending.
- A recruitment log will be maintained and the fieldworker will record information on how many subjects were contacted and whether they agreed to attend. Reasons for non-attendance and refusal will be noted.
- Once recruitment starts to slow/as the clinic in the next village is being established, data collection at households will be undertaken for participants whose attendance at the clinics was limited by mobility or other issues. They will undergo a sub-set of the full protocol.
- The study manager will make the decision to move to the next village once recruitment appears to be saturated.

Recruitment checklist

1. The fieldworker should complete the following checklist at recruitment:
2. Share the recruitment pack.
    a. If an eligible individual has moved out of the household but is residing within the local area, leave their recruitment pack with their family members.
3. Verbally explain the study, in particular the clinical examination to be completed and the potential benefits and risks, including expected timing requirements and follow up for blood and urine samples
4. Ask the Covid-19 pre-screen questions (Covid-19 safety protocol)
5. Inform the individual of the date, time, and location of the clinic and that they will be reimbursed for any costs
6. Answer any questions that arise
7. Request the individual to:
    a. Attend on time. If the clinic is being conducted in two rounds (morning and afternoon) make it clear to the participant which slot they have been assigned to. Try and be flexible with their slot if they are unable to attend at one of the slots).

b. Bring aadhar card for identification
c. **Bring any medication that they use regularly (i.e., weekly)** (this is key, please make this clear). They can bring this in their recruitment pack.
d. Wear light, loose clothing if possible

Protocol for daily clinic:

1. The evening before the clinic, the study manager will ensure equipment (including laptops and tablets) are sufficiently charged and documents (e.g., consent forms) are prepared
2. On the morning of the clinic, the study manager will:
    a. Cross-check the list of equipment and resources required for the day's clinic
    b. Confirm there are no symptoms/positive tests for Covid-19 within the team or household members
3. On arrival at the clinic, the field team will undertake daily calibrations, setup the clinic, and follow the Covid-19 safety procedures (e.g., sanitising stations, setting up outside space for data collection, donning PPE).
4. The clinic helper will ensure that the contact person in the village has arrived with the subjects for the morning slot. They will visit the households if necessary to remind the subjects scheduled. The study manager and one fieldworker will also conduct household visits to motivate participation at the beginning and end of each day (for the following day).
5. Participants will be asked to put on a facemask as they arrive and sanitise their hands. They will undergo the Covid-19 pre-screen questions again and have their temperatures taken (see Covid-19 safety protocol for full procedure).
6. Participants not screening positive for likely Covid-19 will then have the participation information sheet explained to them again and be offered the consent form to sign/ thumbprint once the information is understood and they have had their questions answered.
7. Once the participant has been linked to their APCAPS ID using the label in their recruitment pack (or been given a temporary ID if they cannot be identified in the clinic), they will be asked to wear their ID label. The label will also be attached to the list of the clinic measures for fieldworkers to check off at each station. There will be a separate list for the age groups 18-44 and 45-plus.
8. All the subsequent information will be entered into the ODK questionnaire including results of clinical screening measures.
9. The participant will then move through each of the stations (table 3). As much as possible, questionnaires will be conducted earlier in the day to avoid effects of cognitive fatigue. However,

data collection does not always follow the order indicated in table 3 and is influenced by the size of the field team and number of participants attending the clinic.

10. Once a fieldworker checks off the final measure on the participants' list, they will refer the participant to the study manager/another fieldworker.
11. The participant will then be thanked for their time and participation. The fieldworker will explain the following steps: (1) blood and urine collection on the following weekend, (2) reimbursement the following weekend, and (3) the medical report in the following month.
12. Once the maximum number of participants have been recruited for the day, the field staff will pack-up the equipment (crosschecking the list) and document folders. Where possible and if a safe and secure location is available, anthropometry and TANITA equipment will be stored in the site of the village clinic for use during the remaining clinics in the village.
13. The field staff will monitor pending data (appendix 2) and (with the help of the study manager) prepare the participant list for the next day. Phone calls and reminders will be made to subjects attending the clinic next day. The Anganwadi/teacher/helper/contact person identified in the village will be contacted to help ensure attendance at the clinic the next day.

Table 3: Clinic stations and estimated timings (minutes)

Clinic station	**Sample category (age, years)**			**Estimated time (minutes)**
	<45	45+	40+	
COVID-19 pre-screen	X	X		2
Consent	X	X		10
Identification and update of contact details	X	X		3
Diet questionnaire	X	X		25
Physical activity questionnaire	X	X		10
Main questionnaire (sociodemographics, behavioural risk-factors, medical history, symptom-based screening tools, Covid-19 history, healthcare use)	X	X		25
Disability/mental health questionnaire	X			10
Disability/mental health/dementia questionnaire		X		20
Anthropometry (height, weight, circumferences, body composition, grip strength, blood pressure, pulse wave analysis)	X	X		25
CIMT/liver	X	X		8
Cardiac ECHO			X	12
ECG and TBI			X	15
6-m timed walk with video/accelerometer		X		15
Vision examination		X		10
Hearing examination		X		10
Neuropathy examination and foot photograph (diabetics/prediabetics only)				15
Voice (vowels/counting/animal naming) and free speech and breath recordings	X	X		7
Face/body/dental photos	X	X		5
Wearable devices (accelerometer and smart watch for ~48 hours)	X	X		5

Covid-19 safety protocol

Summary:

APCAPS 4th follow-up is taking place during the Covid-19 pandemic and therefore will take precautions to maximise safety of participants and study staff.

General instructions

- The field staff must be sufficiently trained on biosafety and are instructed to strictly adhere to all safety protocols.
- Vehicles used for field visits need to be disinfected before and after every trip.
- All survey staff working in the field (including drivers) should be tested for SARS-COV-2 by RT-PCR (or rapid antigen test if RT-PCR is not feasible) before the first day of data collection, periodically at 2-week intervals, and if presenting symptoms.
- Every team member should monitor his/her symptoms twice a day (morning before field work and after return from the field) and report those to the team lead in case of symptoms.
- Self-assessment (ideally supervised by another team member) should at least include reporting of temperature check for fever (i.e., temperature ≥100.4 °F/38 °C) and reporting of new/worsening cough.
- In case a team member develops symptoms that are consistent with the local suspect COVID-19 case definition, the field manager should withdraw the entire team from field until it can be confirmed that all team members are negative for SARS-COV-2.
- The suspected case should be tested for SARS-COV-2 through RT-PCR Test as soon as possible. All team members should remain in isolation (self-quarantine at home is preferred) until the test result is confirmed as negative.
- If a team member tests positive, the entire team should be advised to be quarantined for 10 days and report if any symptoms consistent with COVID-19 infection.
- The team members can return to work if they do not see any symptoms in the last 7-10 days. If any symptoms are noticed, the team member will report to the field manager and a SARS-COV-2 rapid antigen test needs to be performed.

Human Resources

- All fieldworkers received at least one Covid-19 vaccine prior to data collection.
- Additional fieldworkers will be trained as a backup for specific tasks to avoid disruption of work if another fieldworker is ill or isolating.

- Security for enumerators is needed so that symptoms will be reported: paid leave to be granted if the staff is infected with Covid-19

Screening for current Covid-19 cases

Summary

APCAPS cohort members with active Covid-19 infection are not eligible to participate. Current Covid-19 cases will be screened for at two stages, at recruitment and at the clinic. Potential cases will be requested to attend the clinic for data collection at a later date.

Steps:

Pre-screen (recruitment at the household)

1. When attending participants households to invite them to the clinic in the following days: ask whether the APCAPS cohort member(s) or anyone in the household tested positive for Covid-19 in the past 20 days (either rapid antigen or RT-PCR test)
    a. If yes, ask for the date of the positive test and record this. Inform them you will contact them in the next few weeks to invite them to the clinic.
    b. Contact the household again minimum 21 days following the positive test
2. If no positive test, ask whether APCAPS cohort member(s) or anyone in the household had symptoms of a cold, fever, or cough starting in the past 20 days
    a. If yes, ask for duration of symptoms and recommend they contact their local ASHA worker for testing.
    b. Contact the household again minimum one week following the start of symptoms to check whether symptoms are continuing (considering symptoms of other viral infections will typically subside in a week), leaving longer when possible, i.e., if collecting data in the village for another few weeks.
3. When re-contacting households, ask the above questions again and repeat the process if the household has experienced another positive COVID-19 test or start of COVID-19 symptoms in the interim. If not, invite the APCAPS cohort members to the village clinic for data collection.

Pre-screen (clinic)

1. When participants arrive at the clinic and before taking consent, take their temperature using the Vandelay Infrared Thermometer CQR-T800. If the participant has a fever (temperature ≥100.4 °F/38 °C) skip to (4).
2. If they do not have a fever, ask them the same questions as asked during the household screen.

3. Record their responses if they/a household member has COVID-19 symptoms or a recent positive test.
4. If the participant has a fever or reports a recent positive test or symptoms, request that they return home and inform them that the team will contact them to join the clinic in the above listed period.

Clinic setup and biosafety

Summary:

Data collection should be organised to minimise crowding and contact and avoid enclosed spaces, though some measures will need to be conducted indoors (e.g., if requiring privacy, quiet, flat ground, power supply). The number of people inside at one time should be kept to a minimum. Both study staff and participants should wear appropriate personal protective equipment (PPE) and all equipment should be sanitised between participants.

Equipment

- Clinic building in village (e.g., panchayat office)
- Chairs
- PPE for all staff in the field
    - N95 mask
    - Gloves
    - Face shield
    - Disposable apron
    - Extra masks for participants
- Disinfection/Decontamination Solutions
    - 70% Iso Propyl alcohol (IPA)
    - 7% Lysol Solution
    - Alcohol swabs
    - Sodium hypochlorite 1% solution
    - Hand sanitiser

The following measures should be conducted outdoors when feasible:

- Covid-19 screening, consent and updating contact details
- Questionnaires (with necessary space between respondents for privacy)
- Photographs

- Functioning tests (6m timed walk + videos) (conduct inside if no level ground available, for better lighting or in case of rain)
- Provision of wearable devices

General instructions

1. Decontaminate all the equipment, chairs and surfaces with 70% IPA spray at the beginning of the day and between every participant. Immediately wipe dry more sensitive equipment (blood pressure monitors, fundus imaging camera, vicorder).
2. Study staff should always wear a facemask, face shield, apron and hand gloves.
3. Carry a biohazard bag and discard all the gloves and other personal protection equipment (including participant's masks) in biohazard bag.
4. Advise and recommend the participants to use facemask throughout the interaction. If a participant does not have facemask, provide a disposable mask.
5. Provide hand sanitizer to the participant before signing consent form. Encourage the participants to keep hands away from nose, eyes and mouth throughout. Wipe down pens after they provide consent.
6. Provide all the required information to the participant before starting to record measurements to minimize cross talk.

Standard Operating Procedures (SOPs)

Anthropometry (height, weight, body composition, waist and hip circumference) SOP

Summary:

Anthropometric measures can be used to understand people's risk of cardiovascular events (e.g., heart attacks). All participants are eligible to be screened for the anthropometry measures: standing height (two readings), body composition and weight (two readings), and waist and hip circumferences (two readings). A fieldworker of the same gender as the participant should conduct the anthropometry measures.

Equipment:

- Seca Leicester stadiometer with base plate (accurate to 1mm)
- Seca 899 portable digital scales (accurate to 100g)
- TANITA BC418 M57NA
- ADE metallic tape
- Spirit level

Preparation:

- The scales, stadiometer and TANITA should be placed on the most level part of the floor (check the air bubble on the TANITA or use the spirit level for confirmation of this).
- Calibrate the scales and stadiometer at the start of every day.
- Ask the participant to remove their shoes.
- Measurements should be conducted in normal and light indoor clothing. If the participant is wearing bulky outdoor clothing (e.g., coat, shawl, pull-over etc.) that is possible to remove, request them to do so.

Quality control

- Take care to avoid digit preference (e.g., rounding to 0) when taking recordings and use the correct units.

Standing height SOP

Steps:

1. Ask the participant to stand on the stadiometer as tall and straight as possible, and check the following points:
    a. Feet flat on the centre of the base plate, ankles together, heels resting on the bar at the back, and the inner borders of the feet at an angle of 60 degrees;
    b. Back as straight as possible, preferably against the rod but not leaning on it;
    c. Arms resting by sides, not behind or in front; and
    d. Head in the Frankfurt plane (eyes looking straight ahead such that the lower edge of orbit is in line with external auditory meatus i.e. ear hole).
2. Instruct the participant to keep their eyes focused on a point straight ahead to breathe easily.
3. Lower the headrest while ensuring the participant is not standing on tip-toe.
4. Record the height to the nearest 1mm. The observer should be level with the scale at the time of reading to avoid errors. To ensure this, the observer may have to stand on a stool or a thick book.
5. Repeat steps 2-5 for the second reading.

Waist and hip circumferences SOP

Quality control

- Circumferences should be recorded with the zero end of the tape held in the left hand above the remaining part of the tape held by the right hand. The plane of the tape should be perpendicular to the long axis of that part of the body, and parallel to the floor.
- The tape should not be pulled too loose or too tight, held snugly around the body part but not indenting it. In some individuals there may be gaps between the tape measure and the skin, in such cases attempting to reduce the gap by increasing the tension of the tape is not recommended.

Prepare the participant:

- Explaining that you will measure the size of their hip and waist.
- Asking them to stand straight with their abdomen relaxed, weight evenly balanced on both feet, and arms hanging loosely.

Waist circumference

Steps:

1. As much as possible, waist circumference should be measured on the bare skin.

2. Face the participant and place the tape around the participant, in a horizontal plane, at the level of the natural waist, which is the narrowest part of the abdomen between the ribs and the iliac crest (top of the hip bone), as seen from the anterior aspect.
3. Ask the participant to breathe out gently while looking straight ahead.
4. Take the reading at the end of the normal expiration to the nearest 1mm. Also record whether the participant is wearing bulky clothing that prevented measuring their bare skin.
5. Repeat steps 2-4 for the second reading.

Hip circumference

Steps:

1. The measurement is carried out with the participant wearing normal indoor clothing.
2. The tape measure is applied to the widest part of the buttock. This is ensured by the observer squatting at the side of the participant so that the level of the maximum extension of the buttocks can be seen.
3. Attention should be paid that the hip muscles of the participant are not contracted, and the tape is horizontal and not compressing the skin.
4. Take the reading to the nearest 1mm and record whether the participant is wearing particularly bulky clothing.
5. Repeat steps 2-4 for the second reading.

Body composition and weight SOP

Quality control:

- Ensure the soles of feet are free of excess dirt.
- Do not measure on a surface that is strongly vibrating.
- Do not take measurements while using transmitters, such as mobile phones, which may affect readings.
- Avoid taking measurement of participants after vigorous exercise (wait till they have sufficiently rested).

Prepare the participant:

- Asking whether they have an implanted pacemaker – if yes, do not do the TANITA measure and move on to the circumferences.

Steps:

1. Turn on the Power: Press the ON/OFF key.
2. Enter Clothes Weight: Enter the approximate weight of clothes worn by the participant using the numerical keys.
3. Select the Body Type: Select the body type from Standard Male, Standard Female, Athletic Male and Athletic Female.
4. Enter Age.
5. Enter Height.
6. “STEP ON” while flashing arrow will appear next to “STEP ON”.
7. Ask the participant to step on the weighing platform with bare feet in a stable position without bending the knees so they touch the electrodes.
8. Make sure heels are placed on the posterior electrodes, and the front parts of the feet are in contact with the anterior electrodes.
9. Ask the participant to hold both arms straight down while taking measurements.
10. Ensure that the participant’s arms are not touching the side of the body and inner thighs are not touching each other.
11. Ask the participant to hold the grips only after the body weight figure on the display has stabilized.
12. When the grips are grasped with both hands, “0000” will appear at the bottom of the display and the impedance measurement will begin. The “0000” marks will disappear one by one during the measurement; after five full cycles, the measurement will be complete.
13. The participant should not step off the platform until the “0000” symbols disappear completely.
14. Once the body weight and impedance measurements have been completed, the overall body fat percentage will be shown at the bottom of the display and a buzzer will sound.
15. The printer should be ON such that the measurement results are printed out.
16. Repeat the above steps to take a second body composition/weight reading.
17. Press the “ON / OFF key and turn off the power.
18. Take a photo of the report by following the below SOP.
19. If the TANITA does not function, measure the participant’s weight with the seca scales and the below SOP.

TANITA photo

Summary

The body composition results are printed automatically by the TANITA machine. To save time inputting data in the field, we will extract the data automatically using photos of the results report at a later date. For the data extraction to work smoothly, the photos of the TANITA reports need to be similar to each other and the report needs to be laid out flat. Take the photo of the report while the participant rests for their blood pressure measurement.

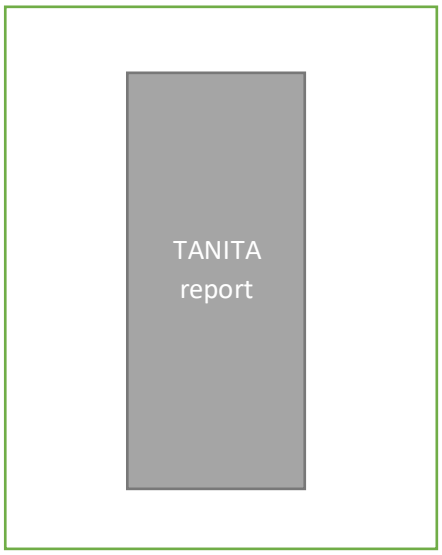
Equipment

- Tablet with camera app (within ODK)
- Printed TANITA report
- Clipboard with two clips

Steps

1. Write the participant's ID on the back of the TANITA report.
2. Lay out the report on the clipboard, clipping the top and bottom ends so that the paper is as flat as possible (not bent or crumpled). Please ensure that the clips do not cover any of the text.
3. Take a photo of the report using the camera app within ODK, under the relevant TANITA photo question in the anthropometry questionnaire.
4. Ensure that the report lies straight, the sides of the report are parallel to the camera frame, and the report lies in the centre of the frame. Always take the photo while holding the tablet straight (not landscape) (please see figure 1 below). Take the photo as close to the report as possible while keeping the whole report within the frame.
5. Check the photo once it is taken to ensure it is not blurry.
6. Store the report (with the participant ID written on the back) securely with the other reports. This will be used to cross-check the data if the photo is unusable.

Figure 1: Recommended dimensions of photo of TANITA report



Weight SOP

Summary:

Weight will be measured using the TANITA alongside body composition parameters. If the participant does not complete the TANITA station, their weight should be measured with the Seca scales. All participants are eligible for weight screening.

Steps:

1. At the time of each reading, ensure the monitor reads ‘zero’.
2. Ask the participant to stand on the scale reasonably straight and looking ahead.
3. Record the weight to the nearest 0.1kg. Weight should be recorded only when the reading on the monitor had settled. Avoid taking the reading as the participant is coming off the weighing machine.
4. Repeat steps 1-3 for the second reading.

Grip strength SOP

Summary:

Grip strength is a good measure of body strength and overall health. Participants will have their grip strength taken in a standing position, with two repetitions in each arm. All participants are eligible for grip strength screening.

Equipment:

- Lafayette Hand-held Dynamometer 78010

Preparation:

- The handle of the dynamometer must be adjusted for the size of each individual subject. The handle should fit comfortably in the hand with enough allowance for a good grip.

Prepare the participant:

- Explaining that you will use the machine to measure how strong their hands are and that it is very important that they try their hardest for the most accurate reading.
- Asking them to remove any large rings.
- Asking them whether they had surgery or experienced any swelling, inflammation, severe pain, or injury in one or both hands within the last 6 months. If they experienced this in both hands, skip the grip strength measures. If only one hand, conduct the grip strength measures in the other (non-injured) hand.

Steps:

1. In a standing position, place the subject's arm at their side keeping it away from the body with the elbow bent slightly (approximately 20 degrees). Demonstrate the use of the instrument to the subject prior to testing.
2. The test is to be administered with dominant hand first and then with the non-dominant hand.
3. Ask the participant to squeeze as hard as they can for a few seconds. Encourage them as they are squeezing, e.g., "squeeze as hard as you possible can". The examiner should be confident that the subject's maximum grip strength is being measured.
4. Stop immediately if the participant feels pain.
5. Complete two trials with each hand, right and left hand alternately, with a pause of 10-20 seconds between each trial to avoid excessive fatigue.
6. Record the amount of strength registered at each trial to the nearest whole kilogram. Also record their usual dominant hand.
7. Return the dials to the "0" position after every trial.

Brachial blood pressure and pulse wave analysis SOP

Summary

Participants will have their brachial blood pressure taken in the right upper arm when sitting (three readings) using the Omron HEM-7121 and the Uscom BP+ Monitor (approved by the British

Hypertension Society). The BP+ Monitor will simultaneously conduct Pulse Wave Analysis. All participants are eligible for blood pressure screening/pulse wave analysis.

Equipment

- Uscom BP+ Monitor with three sized cuffs: (a) Small cuff (arm circumference 17-22cm), (b) Normal cuff (arm circumference 22-32cm), (c) Large cuff (arm circumference 32-42cm).
- Omron HEM-7121 with three sized cuffs: (a) Small cuff (arm circumference 17-22cm), (b) Normal cuff (arm circumference 22-32cm), (c) Large cuff (arm circumference 32-42cm)
- SD card
- Power adapter
- Digital thermometer
- Pillow or other support for arm
- Chair with back support
- Table
- Measuring tape

Quality control

- The participant should not have participated in any exercise or smoked, drunk caffeine or alcohol, in the preceding 30 minutes. As such, avoid measuring blood pressure early in the clinic.
- The cuff should not be too tight or too loose; it should fit snugly so that it is just possible to fit two fingers between the arm and the cuff.
- Do not place the cuff on thick clothes or roll up the sleeve if it is too tight. The sleeve of the dress should not constrict the blood flow in the arm. If so (either because of tight fitting shirt/blouse or rolling up of tight sleeve), take steps to address this (e.g. asking the subject to take off shirt over that arm or in case of female subject provide them with a loose gown to change into).
- Participants' legs should not be dangling and should be uncrossed. Mark a foot shape on the floor to indicate where to place their feet.
- Participants' back should be supported by the chair.
- If the participant moves or talks during the measurement or the measurements appear inaccurate, repeat the measurement.

Prepare the participant:

- Check the subject has not undertaken following activities in the 30 minutes preceding the examination:
    - Strenuous exercise
    - Eating
    - Drinking caffeine or alcohol
    - Smoking or drugs that affect blood pressure.
- Explain that the device will inflate the cuff around the arm twice per reading, and three readings will be taken.
- Ask the subject to sit on the chair with right arm on the table. Upper arm (cuff when applied) should be at the level of the heart. If required use a pillow or some other support to ensure this.
- Measure room temperature: The BP apparatus will give accurate readings at temperature range of 10 – 40 degree Celsius. If room temperature is outside this range, take steps to address this (use room heater if too cold or cooler or table fan with cloth soaked in water if cooler not available if too warm).

BP+ monitor setup

Steps:

1. Insert the plug at the end of the cable attached to the AC wall adapter into the device in the socket indicated as the External DC input socket labelled ⎓. The device will turn on once the power supply has been connected.
2. Connect the extension hose to the cuff by pushing the air fittings together until you hear and feel a positive *click*.
    a. To disconnect the extension hose, pull gently on the grey portion of the hose fitting to release the internal lock, and remove hose from device.
3. To connect a cuff, push the cuff hose fitting into the circular inline socket at the remote end of the extension hose. You should hear and feel a positive *click*.
    a. To disconnect a cuff, gently pull the inline fitting on the extension hose to release it from the short hose attached directly to the cuff.
4. Enter the SD card into the slot at the front of the unit.
    a. The screen should display the following icon if the card is recognised 
    b. If the card is not recognised, the screen will display the following icon  or not display any SD card icon. To troubleshoot, remove and reinsert the card, or insert a different card.

Measure BP/PWA

Steps:

1. Apply the correct size cuff for the BP+ monitor. This should be determined by the arm circumference (see above), which should be measured with a tape measure. The grey coloured band (indicating the centre of the bladder) should be positioned 1-2cm above the elbow joint on the inside of the arm. Close the cuff with the fabric fastener. The artery marker on the cuff where the hose enters the cuff should be placed over the brachial artery.
2. After the cuff is applied, wait for five minutes before taking the first reading. The participant should be made to relax during this time by asking them sit comfortably, to breathe easily and to relax the body and arm, and explaining the procedure. Stress that they should not move, talk or touch the device during measurement. This period should also be used to take a photo of the TANITA report and to note down information in the tablet (cuff size used and arm side on which the measurement is being made).
3. Support the subject's forearm on a stable, horizontal surface such as a table top, at a height such that the cuff is at the approximate level of the subject's heart and held away from the subject's torso. Generally, a palm-down position is found to be more comfortable.
4. Press the START button on the machine. There may be a short pause while the device performs a pre-measurement check. The device will then begin inflating the cuff.
5. The device will inflate to measure the brachial pressure, it will then deflate and automatically inflate a second time. The second inflation will last approximately ten seconds. Ensure the participant remains still and relaxed throughout.
6. Press any button to cancel the measurement and deflate the cuff if necessary.
7. Once the reading is complete, the results are displayed on the monitor's screen. Press the right arrow to view the test number of the reading as stored on the SD card.
8. Note down the systolic and diastolic blood pressure and the test number for the reading in the ODK questionnaire.
9. Wait for 2-3 minutes before taking the next reading so that blood circulation can resume. Repeat the above steps to take an additional two readings.
10. Note down any problems encountered.
11. Once the measure with the UScom BP+ monitor is complete, wait another 5 minutes and repeat the above SOP with the Omron monitor. The Omron monitor only measures brachial blood pressure and therefore will not inflate a second time.

Data transfer: See data transfer section below for details of how to save the UScom data.

ECG and TBI SOP

Summary

ECG and TBI will be measured in the same station as they both require the participant to be in a supine position. Participants aged 40-plus are eligible for both the ECG and TBI measures. Participants should be asked to lie quietly and relax in a supine position for 10 minutes. As they lie in this position, prepare for the ECG and the TBI measurements (e.g., apply the electrodes, arm and toe cuffs, and toe and finger clips). Conduct the ECG, then conduct the TBI measurement. Note whether the ECG and TBI measurements have been completed in the relevant ODK questionnaire.

ECG SOP

Summary

The ECG obtains a tracing or measurement of electrical conduction which controls contraction of the myocardium (heart muscle). It can aid in diagnosis of a number of cardiac conditions including ischemia, hypertrophy, previous or current infarction and rhythm abnormalities.

Equipment

- Cardiax ECG system:
    - Cardiax ECG recorder/machine (USB only connection or both USB and Wi-Fi connection)
    - USB cable for connection to PC (A-mini-B)
    - Cardiax software
    - ECG Leads
- Laptop / All in one PC with pre - installed software “Cardiax” (requirement: Windows XP, Vista, Windows 7, 8/8.1, 10 (32 or 64 bit) operating systems)
- Examination Table
- Hanger for clothes
- Safety razor/Trimmer
- Pillow
- Self-adhesive electrodes
- Alcohol hand gel
- Disinfectant wipes
- Alcohol wipes for skin

- Disposable sheet

Preparation

- Connect the ECG recorder to the computer using a standard USB cable (shipped with the device). The cable has two different connectors, one that fits into the device ("mini-B" end) and the other into the computer ("A" end).
- The operating system of the computer will automatically recognize the ECG, whereupon the yellow LED on the device light up and starts blinking.
- In case blinking is not started in 10 seconds after connection, check the USB cable or the USB port on the computer by using/plugging another one.
- Ensure there is sufficient paper in the printer.
- Plug in and check that the ECG machines working as per manufacturer's instructions.

Prepare the participant:

- Make sure the individual has relaxed for 10 minutes before recording;
- Inform patient of need for the test and obtain verbal consent after explaining the procedure. Explain that procedure is not uncomfortable or dangerous and can be conducted in every person including people with pacemakers;
- Inform the participant that the ECG takes a tracing of the heart and does not involve the use of electricity;
- If there is a female participant a female attendant either from her family or any female member form the staff must be present to carry out the procedure.
- Ask participants to loosen or remove the top half of their clothing (shirts or blouses) to allow access to the chest; Women may keep their brassiere if they prefer. They should also remove shoes, socks, tights or stockings necessary to allow access to areas where electrodes will be placed. They should lie comfortably on the bed/couch at an angle of approximately 45° (or head on two pillows). Ask participants to relax with arms by their sides and legs extended.
- Prepare subject's skin by wiping chest area thoroughly with skin cleansing alcohol swabs to remove oil on the skin. It may be necessary to shave some hair off the chest: (i) To reduce the contact between chest and the electrode and therefore prevent conduction of the electrical wave from the heart; (ii) To reduce the pain/discomfort for the participant when the electrodes were removed, as hair would be pulled out. If shaving is required, permission must be sought from the patient first.

- There are 6 chest leads and 4 limb leads that are attached to the patient using electrodes.
- Apply disposable electrodes first then place appropriate leads on following mentioned marks (Fig 1 and 2).

Placement of chest leads (must be positioned in standard place)

- Locating placing points for V1 and V2 - First, correctly place V1 and V2; the other chest leads are placed in relation to these chest leads. To place V1 and V2 correctly, identify the ridge on the sternum which is approximately 4 cm below the top of subject's sternum. This ridge corresponds with second intercostal space. Feel down on left side of the chest to mark third and fourth intercostal space. Mark the left fourth intercostal space with skin-safe marker. This point corresponds to chest lead V2. Mark V1 in the mirror position on the opposite side of the chest.
- Locating placing points for chest leads V3, V4, V5 and V6 - First, locate the mark for V4 and V6, then place V3 and V5 in relation to V4 and V6. Locate the point for V4 one intercostal space lower than V2, in line with the middle of the clavicle. For V6, track along left side of the subject's chest up to the mid-auxiliary on the same level as V4. Mark the point between V4 and V6 as V5. Mark the point between V2 and V4 as V3. Carefully apply chest electrodes at the below marked points.

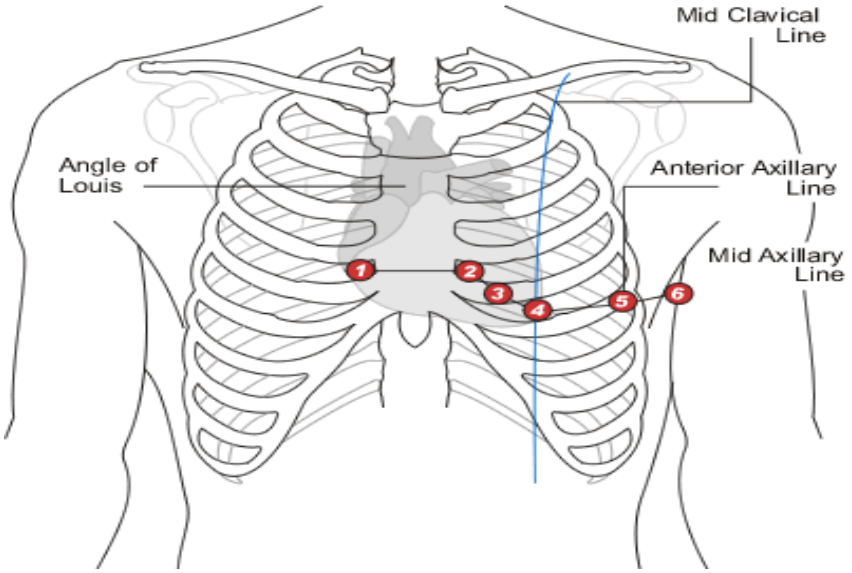


Figure 2: Position of chest leads for ECG measure

- V1 – 4th intercostals space, right sternal border
- V2- 4th intercostals space, left sternal border
- V3- midway between V2 and V4
- V4- 5th intercostals space, mid- clavicular line

- V5- left anterior axillary line at the level of V4 (midway between V4 and V6)
- V6- left mid-axillary line at the level of V4

- Placement of limb electrodes limb leads -
  - Right arm (aVR- red) –inner aspect of right wrist
  - Left arm (aVL- yellow)- inner aspect of left wrist
  - Right leg (neutral- black) – inner aspect of right ankle
  - Left leg (aVF- green)- inner aspect of left ankle

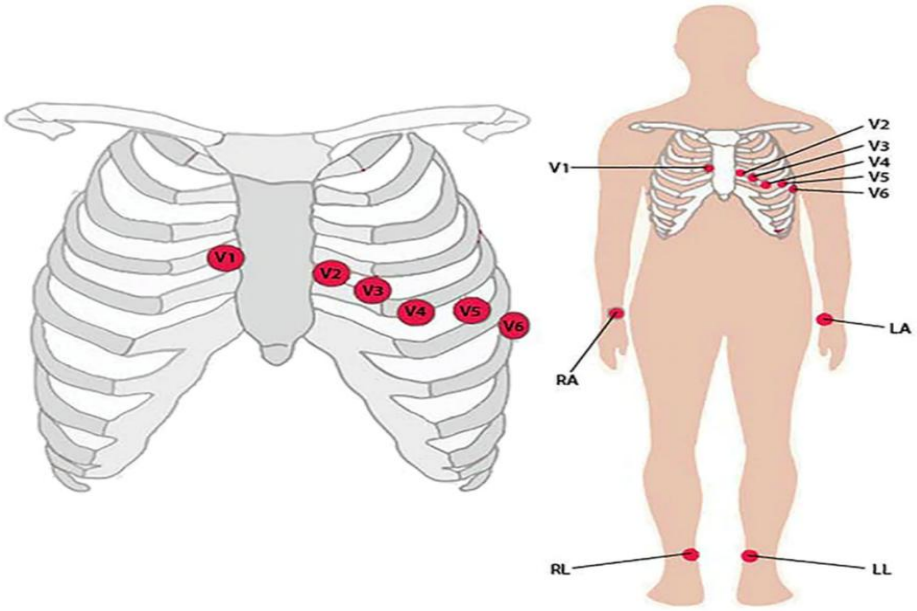


Figure 3: Position of limb leads for ECG measure

- If there is a problem attaching sticky electrodes, use alternative electrodes.
- Ask participant not to move or talk while the ECG is taking place but to breathe normally. Common problems are caused by poor contact of electrodes and patient movement.

Steps

1. Carry out 12 lead ECG. Observe ECG on screen. Wait 10 seconds for participant to relax and ECG to stabilise before pressing record button (F9: Mode continuous save). There will be 12 different recordings, 6 from the chest marked V1 to V6 and 6 from the limb leads marked VR, VL, VF, I, II, and III.
2. Check the ECG is complete and that there are no problems. If necessary, use filter to eliminate muscle artefact. However, try to avoid using filter more than necessary by waiting for participant

to relax completely before taking ECG. You do not need to record ECG for 5 minutes for heart rate variability.

3. Duration of ECG is 30-35 seconds with time divided as follows:
4. Participant at rest - 15 seconds
5. Ask the participant to breathe in (inspiration) - approximately 3-5 seconds
6. Ask participant to hold their breath for 5 seconds
7. Ask participant to breathe out (expiration) - approximately 3-5 seconds
8. Participant at rest - 5 seconds
9. Save digital ECG to Cardiax device.
10. Once ECG completed, remove electrodes and leads and allow participant privacy to dress.
11. Clean ECG leads with disinfectant wipe after each participant.

Checking the quality of the ECG waveforms

- After saving an ECG recording in Cardiax software, go to main screen (the Card File window), the right-hand side of the window contains the 'Patient List' and the left-hand side of the window shows the 'Patient Card' of the patient selected from the list. Select a subject for whom you want to save the ECG image for quality check. Select ECG recording and the waveforms for 12 leads will show up; click on 'File' icon and select 'Picture export'; save the image in a PDF format in the designated folder. Repeat the same procedure to save the single beat for 12-lead ECG and save it in the same folder. Thus, there will be two images: 12-leads ECG for 16 seconds and a median beat.
- Save the image as a pdf and name it with the patient ID.
- Keep both images in the folder C:\Documents and settings\DOCTOR\My Documents\APCPAS ECG\APCPAS ECG Quality Images.

ECG – Protocol for Saving Data

- The research coordinator at the end of the day will store data for each participant in two main excel spreadsheets (in csv format) on the laptop: C:\Documents and settings\DOCTOR\My Docume-nts \APCPAS ECG\ APCPAS ECG All Images;
- Spreadsheet names:
    - 'ECG interpretation findings' - ECG interpretation values (X, Y coordinates)
    - 'ECG diagnosis findings' - ECG diagnosis values (intervals and complexes)

- To save 'ECG interpretation findings' in excel file (in csv format), select the ECG recording from the 'Card File window' and go to Menu: File / File export (in .csv format) and save it in the designated folder (mentioned above).
- To save 'ECG diagnosis findings' in excel file (in csv format), select the ECG recording from the 'Card File window' and go to Menu: mode / Diagnosis, select parameters and export the output in .csv format and save it in the designated folder (mentioned above).

At the end of each week the data stored within the two spreadsheets must be tidied up (by research coordinator) to remove excess information that is not required.

- Open the file '*ECG interpretation findings'* in excel.
- Scroll through the data and delete each row that has titles but no values e.g. code, comm, diag., etc.
- The database should only contain the output for each individual subject and not the title headings for their data. So, rows starting with 'real', 'ID=' etc all need to be kept.
- Repeat steps i, ii, and iii for the '*ECG diagnosis findings'* file.

Data back-up for ECG

- Once the databases have been tidied up each week, folders for 'ECG diagnosis findings and ECG interpretation findings' need to be saved to the CD. In addition, there are 2 folders in the "APCPAS ECG Quality Images" where the quality control images stored as pdfs. These should also be saved to the same CD.
- Compress the weekly folder into a zip file. To do this, right click on the folder, go to SEND TO, then COMPRESSED (ZIPPED) FOLDER. The zipped file should be clearly labelled with the study name and end date for that week. E.g. APCAPS 23rd January 2021, APCAPS 30th January 2021.

Toe-brachial index SOP

Summary

Measurement of the toe-brachial index (with brachial and toe cuffs and PPG sensors on a finger and toe) will be conducted for participants aged 40-plus.

Equipment

- Vicorder with PPG clips, SC10 and SC5 vascular cuffs, 1.9cm cuffs

- Laptop with vicorder software installed
- Bed

Preparation

1. Connect vicorder USB cable to Wipro laptop.
2. Bifurcation ends into 2 USB ports of the laptop.
3. Other end should be connected to the circular port (8-way socket) at the rear of the vicorder box with the red dots lined up.
4. Connect the red and blue leads to the press 1 and press 2 ports on the vicorder box. The red lead goes into the red port and the blue lead into the blue port.
5. Plug in the white cable with finger sensor and blue trim into the blue socket labeled 'PPG1' on the front of the Vicorder box.
6. Plug in the white cable with finger sensor and red trim into the red socket labeled 'PPG2' on the front of the Vicorder box.
7. Switch on laptop. The blue light should light up on the Vicorder.
8. Double click Vicorder icon on desktop.

Prepare the participant:

1. Ask the subject to lie down in the supine position. They should lie in this position for minimum 5 minutes before the first measure is taken.
    a. While the participant is resting, complete the following steps: (a) explain the procedure, (b) apply the arm and toe cuffs and PPG sensors to the finger and toe (c) set up the vicorder programme for the TBI measure, and (d) enter the participant details.
2. Explain that you will start a series of tests which aim to understand how their blood flows through blood vessels in their arms and legs. You will apply cuffs to their arm and toe, which will inflate to measure blood pressure, while sensors on their toe and finger will also measure blood flow). The test is not painful and will only last a few minutes. Please try to not move and relax.
3. Place a 10cm blue cuff around the upper arm with the tube pointing downwards. Attach the tube of this cuff to the red Vicorder lead. Apply the toe cuff to the right big toe.
4. Place the sensor clips at the tip (pad) of the right middle finger and right big toe.
5. Attach the cable from the Vicorder box with the red sensor to the middle finger so that the pulp of the finger sits on the recording section/circle.

6. Attach the cable from the Vicorder box with the blue sensor to the big toe so that the pulp of the toe sits on the recording section/circle.
    a. If the patient has cold fingers or toes these need to be warmed before a good reading can be achieved. Warm with a blanket or by rubbing before attaching sensors.
    b. If the patient is wearing nail varnish it may need to be removed from the nail before recording (Note: it is possible to obtain a reading with nail varnish but check that a signal is obtained. If not, ask the participant if they would mind removing the varnish)

Steps

1. Make sure you have the correct participant highlighted in the patient menu on the left side of the main screen (confirm matching ID number) and the click on 'ABI' in the main menu on the right-hand side
2. Press F12 Mode key to select PPGi measurement mode and dual-channel bilateral modes.
3. Check that you can see a clear signal being received by both sensors on the screen. If not remove nail varnish, warm the extremities or as a last option try another digit on the same hand/foot to obtain flow
4. Warn the patient that the cuffs on their arm and toe will inflate slowly and may be quite tight for a few seconds before quickly deflating. They should remain still, relaxed and quiet during this time
5. Press the spacebar to inflate the cuffs automatically and occlude the arteries- the signal on the screen should disappear and become a flat line. Once both signals have disappeared press the spacebar to freeze the recording and deflate the cuffs.
6. The software should automatically mark the first point of the last beat for both the brachial and toes. Check that the software has marked actual beats and not artefacts. If you need to adjust the markers simply click on the correct place (start of last visible beat) and the cursor and values will be adjusted automatically.
7. Record the TBI PPG index value shown in the bottom left corner of the screen on the record form into the questionnaire.
8. Press enter to save the data.
9. Repeat steps 5-7 so that you capture 2 readings for each subject.
10. If TBI index <=0.7 for at least one reading:
    a. ODK will prompt you to ask the peripheral arterial disease screening (Rose questionnaire) questions

b. ODK will also prompt you to provide the participant with a summary of their results and to refer them to their local PHC for confirmatory diagnosis and support in managing their condition.

Goitre screening SOP

Summary

Goitre is a swelling in the thyroid gland that causes a lump in the front of the neck. The lump can move down up and down when people swallow, in contrast to lumps with other causes, e.g., swollen lymph nodes.

Steps

1. Observe the participant's neck as they sit in a normal position and assess whether it is possible to identify a lump at the front of the neck (e.g., similar to figure 1).
2. If the participant has a lump, ask them to swallow (it may be useful to provide them with a glass of water for this) and observe whether the lump moves.
3. If the participant does not have a visible lump in the normal position, ask them to extend their neck by tilting their chin upwards and again assess whether it is possible to identify a lump at the front of the neck.
4. If the participant has a lump at the front of their neck in the extended position, ask them to swallow and observe whether the lump moves.
5. Note your observations in the ODK questionnaire. Recommend patients with a clear swelling in their neck to visit their local PHC for treatment (**this is particularly important for pregnant women**).

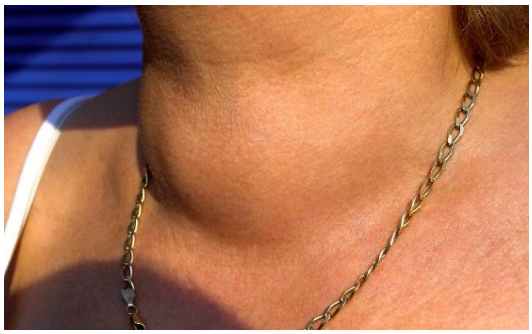


Figure 2: Example of mild goitre (Source: https://www.nhs.uk/conditions/goitre/)

6-meter timed walk SOP

Summary:

The respondent will be asked to walk a 6-meter distance twice at normal speed, both walks will be timed and video recorded. The respondent will be asked to wear an accelerometer on their waist during the walks. Participants aged 45-plus will be eligible to do the timed walk.

Equipment:

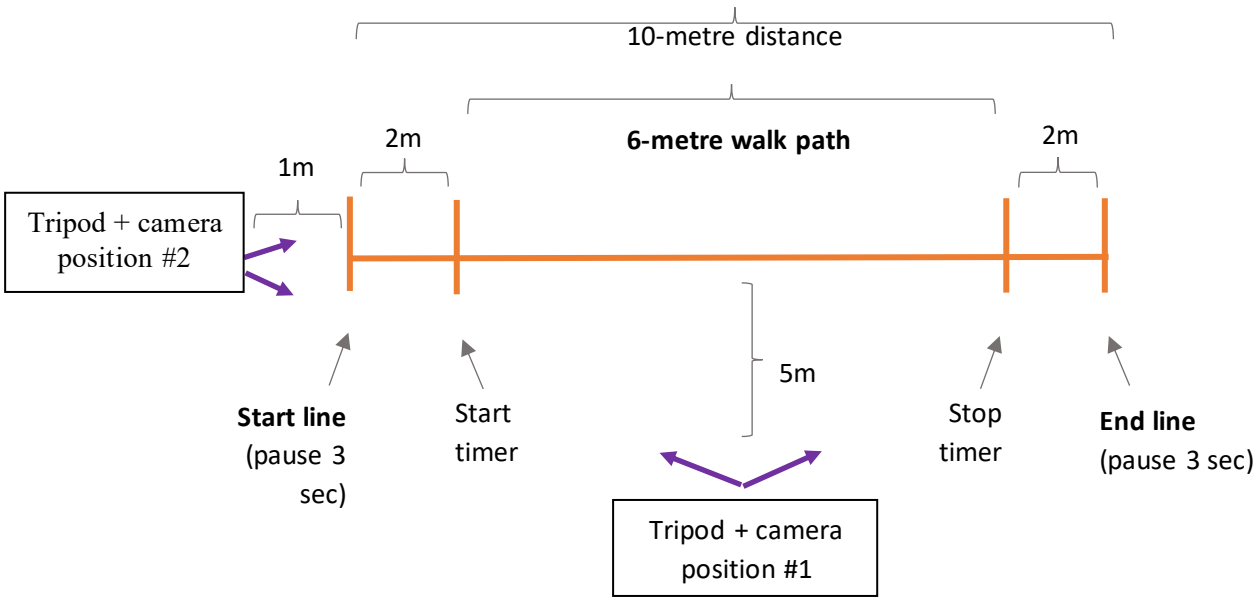
- Measuring tape (10-metre +)
- Masking tape or similar, suitable for sticking to floor surface (if no tape will stick, and item like rope or cones could be used, but distances should be confirmed after every 5 participants to ensure they have not moved out of place).
- 2x tripods for tablets
- 2x tablet (for taking videos with ODK Collect)
- Accelerometer (research-grade)
- Waist belt for accelerometer
- Stopwatch

Preparation (See diagram for set-up):

1. Find a suitable area of safe flat ground that is free from any obstructions. The background visible in the video should be free from movements and plain where possible. If possible, the walk should take place outside of direct sunlight (e.g. in shade or in a well-lit room). This is to avoid strong shadows in the video. Check at intervals through the day that the videos are appropriately lit (e.g., no strong shadows have appeared across the walk area, not too dark or too bright).
2. Measure out a distance of 10-metres and lay down a piece of masking tape along this line. Mark the start and end with a short, perpendicular piece of masking tape. Mark additional lines 2-metres inside each end of the 10-metre line, and measure to confirm the inside distance is 6-metres.
3. Set up one tripod (#1) at 1.3-metre height, 5 metres away from the mid-point of the 6-metre walk, facing the walk line. When inserted into the holder, the video camera/tablet should clearly capture the middle 6-metres of the walk line. Set up another tripod (#2) at 1.3 metre height, 1 metre behind the start of the 10-metre line, looking straight down the length of the line. When inserted into the holder, the video camera/tablet should clearly capture the length of the walk line, such that a person standing on the far end of the middle 6-metres is fully visible (head to toe).

4. Prepare the accelerometer and waist band by making sure they are functioning.
5. Prepare the video recording equipment by entering the participant ID onto tablet/camera and inserting it into tripod in position #2. Ensure the view is flat and the full 6m line is in shot as described above. The tablet being used for data entry for this section will be the camera for position #1. Ensure that the correct participant ID is already entered into this tablet, and insert it into tripod in position #1. Ensure the view is flat and the full 6m line is in shot as described above.

Figure 4: Set-up diagram for 6-meter timed walk



Prepare the participant:

- Explaining that you will ask them to walk a 6-meter distance twice at normal speed. You will time how long it takes to walk the 6-meter with a stopwatch, and make a video recording of the walk from 2 different angles using a camera. Ask whether the respondent is comfortable walking this distance without risk of a fall. Do not perform the walk if the respondent:
    - Cannot walk, even with aid of a walking stick, walker, or leaning on a wheelchair
    - Suffers from dizziness, and/or
    - Has swelling or pain in their hips or knees to the degree which walking 24-metres would be uncomfortable/painful.
- If the respondent usually uses a walking stick or another aid and would be more comfortable with it, then explain that they may use it.

- Explain that you can walk alongside them, if they prefer, to provide support in case they do lose balance. Confirm if they would like you to walk alongside or not necessary. If not necessary, remain behind tripod #2 (i.e. out of view of both cameras) for the duration of the walk.
- Ensure the respondent is wearing appropriate footwear.
- Explain that during the walk they will be asked to wear a waist-worn device called an accelerometer, which tracks their speed and movement. Show them the device and waist band and demonstrate on yourself how it should be worn.
    - If the respondent agrees, ask them to put on the waist band so that the accelerometer pouch is positioned on their lower back around level of L5 vertebra, at the midline. Once positioning is correct, check the accelerometer is switched on and insert into the pouch.

Steps:

1. If respondent is ready, and waist band is in position, switch the accelerometer on and insert it into the pouch. Record the accelerometer model number and the exact time at which it was turned on, into the tablet.
2. Explain "This is our walking course. I want you to walk to the other end of the course at your usual speed, just as if you were walking down the street to go to the store. Start by standing still behind this first line for 3 seconds (start line), and end by standing still upon the last line for 3 seconds (end line). Then turn around and walk back to the start line at your same usual speed. When you reach the start line again, stand still for 3 seconds, before removing the waist band and giving back to us."
3. Demonstrate the walk for the respondent (including counting pauses at start and end). Ask them if it is clear or they have any questions.
4. Have the respondent stand with both feet touching the starting line.
5. Tell the respondent "When I want you to start, I will say: "Ready, begin. OK?". Ensure they have acknowledged this instruction.
6. Go to tripod in position #2 and press record. Then go to tripod in position #1 (side-on to the walk) and press record. Stay in this position (out of view of the two cameras) for the duration of the walk.
7. Say "Ready, begin" to the respondent.
8. Press the start/stop button to start the stopwatch as the participant's foot first crosses the first 6-metre walk mark.

9. Stop timing when the participant's first foot crosses the second 6-metre walk mark. Record time of walk.
10. Repeat steps 8-9 for the return walk.
11. After respondent has correctly competed the walk, stop the recording on cameras in position #1 and then position #2.
12. Collect the accelerometer and waist band from them and stop the data recording.
13. Record the exact time that the accelerometer data finished recording, and note it in the tablet.
14. Enter the walk times (first and second 6-metre walk) from the stopwatch into tablet.

Photographs

Facial photographs SOP

Summary:

Facial ageing can act as a marker of a person's rate of ageing and be associated with health outcomes. We will take one photograph of the participant's face. All participants are eligible to participate in the facial photographs.

Equipment:

- Tablet (for taking photograph with ODK Collect)

Preparation:

- Prepare an area with a green background (e.g., hang a green sheet).
- Aim for the respondent to be in natural light (e.g., facing a window if inside or facing the sun if outside).

Quality control

- Aim for even light across the face, avoiding shadows.
- Avoid the participant's face being silhouetted (i.e., taking the photo with the sun behind them).
- The participant should have a neutral facial expression, their face should not be covered by their hair, glasses or other items.

Prepare the participant:

- Explain that you would like to take a photo of their face. This photo will be used to understand how they are ageing and whether it is related to their other characteristics (e.g., whether they are agricultural workers or not). Make it clear that they do not have to have their photo taken.
- Place the participant around 0.5m from the background surface.
- Ask them if they are willing to remove any head coverings (e.g., if they are not used for religious reasons) and glasses.
- Ask them to hold their head straight, stare straight ahead at the camera and to keep a neutral facial expression.

Steps:

1. After preparing the participant, stand around 0.6m distance from them.
2. Take one photo of their face using the ODK app on the tablet. The whole of their face should be captured (including their hair), from the top of their head to the top of their shoulders.
3. Repeat if you are unable to capture the optimal photo but only save one photo.

Dental Photographs SOP

Summary:

Adverse dental health is an important contributor to healthcare use and multimorbidity, and may be a marker of biological ageing. Certain behavioural aspects (such as tobacco use) might also be identifiable from dental examinations. We will take one photograph of the participant's mouth, while they hold their lips and cheek back with their hands.

Main data collection - Equipment:

- Tablet (for taking photograph within ODK app)
- Clear plastic cheek/lip retractor (sterilised since last use) (for use with 5% repeatability sample)

Main data collection - Preparation:

- Ensure background conditions as per the facial ageing photograph (this SOP should be conducted directly after that).

Quality control:

- There should be sufficient light on the face to distinguish the colour on the teeth and gums. The mouth should not be overly shadowed by the face (may be the case if strong light from above). See figure 2 for reference.

Prepare the participant:

- Explain that you would now like to take a photograph of their front teeth and gums. They will hold back their lips/cheek with their hands. It will not involve the research team making any contact with their face or mouth.

Steps:

1. Take 1 photograph where the participant holds up their top lips (so top teeth and gums are clearly visible).
2. Take a second photograph where the participant holds down their bottom lips (so bottom teeth and gums are clearly visible) (see figure 2).

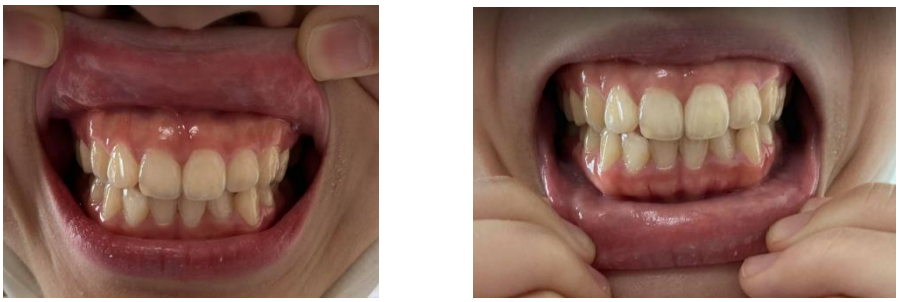


Figure 5: Example of dental photographs taken without cheek retractor (Photograph A (left; upper gum/teeth) and B (right; lower gum/teeth)

Repeatability sample – dental photograph with cheek retractor SOP

Summary

For the 5% repeatability sample, we will take one photograph of the participant's mouth while they wear a clear plastic cheek/lip retractor.

Equipment:

- Tablet (for taking photograph within ODK app)
- Clear plastic cheek/lip retractor (sterilised since last use) (for use with 5% repeatability sample)

Preparation:

- Ensure cheek retractors are sterilised since last use (stored in a separate and clearly labelled box from the used cheek retractors).
- Ensure background conditions as per the facial ageing photograph (this SOP should be conducted directly after that).

Quality control:

- There should be sufficient light on the face to distinguish the colour on the teeth and gums. The mouth should not be overly shadowed by the face (may be the case if strong light from above). See pictures below for reference.

Prepare the participant:

- Explain that you would now like to take a photograph of their front teeth and gums. This will involve them placing a clean plastic device called a cheek retractor into their mouth. It will not involve the research team making any contact with their face or mouth. Make it clear that they do not have to participate in this section of the protocol if they do not want to wear the retainer.

Steps:

1. Give the participant the cheek retractor to insert and ensure it is placed correctly. Both top and bottom gums and teeth should be visible (see figure 3).
2. Take a photograph (within ODK) so that the whole mouth is in shot (see figure 3).

Figure 6: Example of dental photograph taken with cheek retractor

Body photograph SOP

Summary

We propose that photos/videos of the body could be a novel way to characterise people's fat and muscle distribution and associated disease risk with minimal participant burden (e.g., anthropometric measures). During primary data collection, we will take three photos of the participant from different angles (front, side, back).

Prepare the participant:

1. Requesting them to remove any bulky outer clothing (if comfortable).
2. Ensure background conditions as per the facial and dental photographs (this SOP should be conducted directly after that).

Steps

1. Ensure the respondent's ID is entered into the ODK.
2. Ask the respondent to stand with arms stretched out at a right angle to the body in a "T" pose. Legs should be roughly shoulder width apart.
3. Take one photo of the participant at a front angle (i.e., face-first). The photo should cover their whole body, from feet to neck.
4. Crop the photo if the participant's face is in the frame.
5. Repeat, taking one photo of the participant at a side angle.
6. Repeat, taking one photo of the participant from the back.

Repeatability sample - Body shape video recording SOP

Summary:

Participants in the 5% repeatability sample will be asked to stand on the spot and rotate through 360 degrees while being video recorded.

Equipment:

- Tripod
- Tablet (for taking video with ODK Collect)
- Masking tape

Preparation:

- This measure can be taken directly after the timed 6-metre walk, using the tripod, camera and floor markings already set-up. Tripod in position #2 can be used (as it is 3m from the start of the 6m walk, which can be used as marker point on the group on which the respondent will rotate).
- As in previous SOP, the background should be a plain as possible, with nothing moving in it, and no people in it.

Steps

1. Ensure the respondent's ID is entered into the camera/tablet.
2. Explain to the respondent that you will ask them to rotate slowly in a full circle, whilst standing on the spot. Arms will be arms stretched out at a right angle to the body in a "T" pose. Legs should be roughly shoulder width apart. They should move their legs as little as possible whilst turning. One full turn should take about 12-15 seconds. Demonstrate this process to them.
3. Ask if the respondent has understood or has any questions. If respondent is unable or uncomfortable doing this motion, they may keep hands by their side, or opt not to participant in this measure.
4. Ask the respondent to stand on the cross (where 10m line meets 6m walk start point, ~3 metres from the camera). They can use this to stay in the same place for the duration of the turn.
5. Explain that you will say "ready, go" and then they should start the turn.
6. Stand behind the camera (out of view), and press record. Say "Ready, go".
7. Once respondent has completed the turn, stop the recording.
8. Ensure the recording is saved with correct participant ID.

Household photographs SOP

Summary

Household asset indices are a recommend method for measuring material wealth and socioeconomic status in India. However, questionnaire-based asset indices are time-consuming. We propose that this information could hypothetically be measured through applying machine learning techniques to photos of participant's houses, thus reducing the respondent burden. All APCAPS households (i.e., a household whether at least one APCAPS member is residing permanently in the villages) are eligible for the household photograph, which will be conducted alongside the household questionnaire in their house.

Prepare the participant

- Explain that we wish to take photos of the inside of their house as a way of measuring what assets they own and the style of house they live in, without asking long questionnaires.
- Explain that they do not need to consent to having these photos taken.

Quality control

- Ensure that no individuals are visible in the photos. If a person is unable to leave the room, either angle the photo so only their back is visible or do not take the photo.

Steps

1. Take a photo of the main living room, taking in as much of the room as possible.
2. Take a photo of the kitchen, taking in as much of the room as possible.

Vision impairments SOP

Summary:

The visual acuity examination uses a chart with varying sized ‘E’s to assess people’s near and distance vision. Participants aged 45-plus are eligible for both near and distant vision screening.

Equipment:

- Tumbling E ETDRS Chart (4-meter)
- Tumbling E Near Point Vision Chart (40cm)
- Chair

Preparation:

- Make sure the vision charts are not scratched or marked - it may damage the lettering on the charts, and the results of the vision test. You may choose to keep the charts in their plastic sheaths for transporting, but remove when doing the testing.
- Make sure the vision charts are well lit
- Make sure the surface does not reflect glare, making it more difficult for the respondent to see.
- If a respondent uses glasses or contact lenses, conduct the test using them.
- For assessing distance vision, measure the 4-meter distance and setup a chair at one end with the 4-meter chart at the other end.

Quality control:

- Make sure the person does not lean in closer to the chart during the test. If they have leant forward considerably, ask them to reposition and start again.
- Take care that you are entering the score correctly for each eye: if they are covering their left eye then you are measuring visual acuity in their right eye (and enter data under right eye) and vice versa.

Steps:

Distance vision

1. Ask respondent to sit at the end point of the course. Then position yourself so you can see both the respondent and the chart clearly.
2. Adjust the chart height if necessary to ensure the fourth line on the chart is level with the respondent's eyes.
3. Ask respondent to place her/his left hand in front of her/his left eye.
4. Ask respondent to state the direction of the E either verbally (up/down/left/right) or by pointing. Demonstrate this using the top line. Ask him/her to start with the large letters and move progressively to the smaller ones. Explain that they can take it slowly.
5. Once the respondent has started a line, she/he should complete the line. If the respondent is struggling, encourage them to guess.
6. If at least three Es are missed/said incorrectly on a line and all letters on that line have been attempted, end the test at that point.
7. Select and record the result from the column labelled "DECIMAL" on the left side of the chart for the smallest line that the respondent read completely correctly.
8. Ask respondent to place her/his right hand in front of her/his right eye. Repeat steps 4 to 7.
9. In the better eye and when using glasses/contact lenses, a score of <0.50 indicates mild vision impairment, <0.30 indicates moderate vision impairment, and <0.1 indicates severe vision impairment. The questionnaire will notify you if the respondent’s results indicate moderate vision impairment, please refer them to visit the area hospital for further testing.

Near vision

1. Have the person place the end of the string attached to the near vision chart between forefinger and middle finger. Then place the palm over the eye with the same hand. Their free hand is used to hold the chart.
2. Ask respondent to place her/his left hand in front of her/his left eye.
3. Ask respondent to state the direction of the E verbally (up/down/left/right). Ask him/her to start with the large letters and move progressively to the smaller ones. Explain that they can take it slowly.
4. Once the respondent has started a line, she/he should complete the line. If the respondent is struggling, encourage them to guess.
5. If at least three Es are missed/said incorrectly on a line and all letters on that line have been attempted, end the test at that point.
6. Select and record the result from the column labelled "DECIMAL" on the right side of the chart for the smallest line that the respondent read completely correctly.

7. Ask respondent to place her/his right hand in front of her/his right eye. Repeat steps 3 to 7.
8. In the better eye and when using glasses/contact lenses, a score worse than M 0.8 (<0.50) indicates vision impairment. The questionnaire will notify you if the respondent's results indicate vision impairment, please refer them to visit the area hospital for further testing.

Hearing impairments SOP

Summary

The hearing impairments test uses a phone-based app and headphones to assess hearing loss. The test is termed a "hearing threshold" test. The participant will listen to noises of different volumes and frequencies through noise-cancelling headphones and indicate at which point they can no longer hear the sounds. Each ear will be tested separately and an audiogram (graphical representation of the sounds the participant can hear) will be generated. Only participants aged 45-plus are eligible for hearing testing. The app is not able to identify causes of hearing loss. These results will be used to classify participants as having normal/ mild/ moderate/ severe/ profound hearing impairments and to refer them on for a confirmatory diagnosis and treatment.

Equipment

- Tablet with Hearing Test (pro) application[2] installed
- Sennheiser HD 458 BT Over Ear Wireless Headphones with Active Noise Cancellation Headphone

Preparation (pre-clinic):

- Setup an account for data storage.
- Open the app
    - Select settings and data, printing and storage
    - Select background synchronization and 'other email', add an email address, setup a password and accept the verification link sent to the inbox
- The app should be calibrated on a weekly basis by a fieldworker with normal hearing (see calibration section for instructions). Note down the date and time of the calibration test and share with the fieldworkers conducting the hearing tests each week. They will need this information to enter into the app for each test.

[2] https://www.e-audiologia.pl/HearingTest/

Preparation (clinic):

- In the app settings select:
    - Threshold test:
        - Test frequencies: 250, 500, 1000, 2000, 4000, 6000, 8000 Hz
    - Intensity step size: 5 dB
    - Audiogram interpretation: Degrees of hearing loss
    - Hearing loss grading: Yes
    - Show statistics: Yes
    - Monitoring of background noise: Yes
    - Selection of calibration coefficient: Yes
- Data printing and data storage:
    - Add patient name: Yes
    - Institution header: Type APCAPS
    - Background synchronisation: Yes
- Find the quietest location available to do the hearing test (it will take around 5 minutes)

Prepare the participant:

- Explain that you will test for hearing loss. The test will involve them wearing a set of headphones that will play beeping noises at different volumes. Each ear will be tested in turn (i.e., the beeps will come out of one side first, then the other).
- The beeps will get gradually quieter. The participant needs to indicate to you (with gestures if possible, verbally is also acceptable) whether they can or cannot hear the beeping.
- Once they cannot hear the beeps, you will increase the volume again. They will need to indicate if the sound is barely audible (i.e., so quiet that if it was any quieter, they would not be able to hear it). Once it has reached this level, the test moves onto another frequency and you will repeat the same process.

Steps:

1. Wipe down the headphones between each use.
2. Give the participant the headphones and check they are comfortable.
3. Explain/decide together the gesture/words (e.g., nodding, hand signals) you want them to use to indicate (a) being able to hear the beeping, (b) not hearing the beeping at all, (c) only barely hearing the beeping.

4. Open the app, select hearing threshold test, other headphones, and use previous calibration coefficients. Select the relevant coefficients for those week's test based on the date/time of the calibration provided at the start of the week.
5. Inform the respondent when you are about to start, and begin the test.
6. As the respondent states they can hear the beeps, select the "I can hear" button. This will decrease the volume for them.
7. Once they state they cannot hear the beep, select the "I cannot hear" button. This will slightly increase the volume for them.
8. Once they state the sound is barely audible, select the "barely audible button". This will move the test on to the next frequency.
9. Repeat for each of the frequencies and both ears.
10. Enter the average hearing threshold for the right and left ear (in dB HL below the audiogram) into the tablet.
11. Once the test is complete, select the test on the left of the screen (holding the test ID down) and select edit (pencil icon) and add the patient's ID. **This is very important.**

Diabetic neuropathy SOP

Summary:

Respondents will be assessed for diabetic neuropathy (nerve damage that primarily affects the extremities such as feet and hands) with a combination of (a) symptom-based questions and (b) an examination of sensory loss in the feet and ankles (following the Modified Toronto Clinical Neuropathy Score protocol[3]). Only respondents with a prior diagnosis of diabetes will be eligible for diabetic neuropathy screening in the clinic. People with undiagnosed diabetes identified by fasting glucose will be screened for neuropathy at their households when they receive their medical referral report.

Equipment

- Chair/bed
- Lancet needles
- Cotton swabs
- 128Hz tuning fork

[3] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2871179/

Preparation:

- Place the participant in a seated or lying position with bare feet, and eyes closed.
- If seated, the participant's feet should be above the ground.

Quality control

- If possible, diabetic neuropathy screening should be conducted by the same fieldworker(s) throughout.
- Fieldworkers should aim to use the same level of pressure in the sensory examination for all participants.
- The sensory examination should be conducted on the right side for all participants.

Prepare the participant:

- Explain that you will ask them questions about symptoms of nerve damage that can be caused by diabetes, and that you will then assess their feet and ankles to identify signs of nerve damage.
- Explain that if you identify potential signs of nerve damage, you will inform them and request them to visit their local health facility for support in managing their diabetes.

Neuropathic Symptoms

In the past two weeks, have you experienced:

1. Burning, stabbing, or shock-like pain in the feet or legs
2. Numbness of feet or legs
3. Tingling in the feet or legs
4. Weakness in the feet or legs (e.g., difficulties standing on your toes or heels, or moving around)
5. Any similar symptoms (pain/numbness/tingling/weakness) in the hands
6. Any feeling of unsteadiness when walking or a sense of imbalance

If the respondent answers yes to presence of symptom, ask:

1. Does this generally affect your sense of wellbeing (i.e., does it bother you)?
2. Does this generally affect you doing your usual daily activities?

See below for scoring (enter into tablet).

Sensory Examination

Steps:

Pin prick

1. Demonstrate the test on the participants' forehead and ask whether they feel "sharpness or pain" (similar to being pricked by a needle/pin, not just a light touch).
2. Press the lancet needle lightly on the skin of the dorsal surface of the big toe and ask the participant how it feels.
3. To be rated normal (0), the participant should report a 'sharp' feeling, similar to the sensation on the forehead. If the participant feels nothing, score = 3.
4. If the participant reports reduced sensation at the toe (in comparison to the forehead), repeat along the line from the big toe to a point above the metatarsophalangeal joint., in discrete dabs, checking for participant response each time. If participant reports reduced sensation up to the metatarsophalangeal joint, but normal beyond, score = 1.
5. If the participant reports reduced sensation, repeat to above the ankle (at the anterior surface of lower end of the tibia). If the participant reports reduced sensation up to the ankle, but normal beyond, score = 2.
6. If the participant reports reduced sensation above the ankle (at the anterior surface of lower end of the tibia), score = 3.

Temperature

1. Demonstrate the test on the participants' forehead and ask them if they feel "coldness".
2. Place the end of the tuning fork on the dorsal surface of the big toe and ask the participant whether it feels warm or cold. To be rated normal (0), the participant should report the metal as feeling cold to the skin, similar to the forehead. If the participant feels nothing, score = 3.
3. If the participant reports reduced sensation of "coldness" (in comparison to the forehead), softly sweep the fork up the foot to a point above the metatarsophalangeal joint. If the participant reports similar cold sensation to the forehead test at this point, score them = 1.
4. If the participant reports reduced sensation, softly sweep again to above the ankle joint (at the anterior surface of lower end of the tibia). If the participant reports similar cold sensation to the forehead test, score = 2.
5. If the participant reports reduced cold sensation above the ankle (at the anterior surface of lower end of the tibia), score = 3.

Light touch

1. Roll up a cotton ball into a swab.
2. Using the cotton swab, lightly touch the participants' forehead and ask them if they feel it.

3. Lightly touch the skin of the dorsal surface of the big toe.
4. To be rated normal (0), the participant should report a similar touch to the forehead. If the participant feels nothing, score = 3.
5. If the participant reports reduced sensation (in comparison to the forehead), softly sweep the swab/filament up the foot to a point above the metatarsophalangeal joint. If the participant reports similar sensation to the forehead test beyond the joint, score = 1.
6. If the participant reports reduced sensation, softly sweep again to above the ankle (at the anterior surface of lower end of the tibia). If the participant reports similar sensation to the forehead test above the ankle, score = 2.
7. If the participant reports less sensation than the forehead test above the ankle, score = 3.

Vibration sense

1. Tap the 128Hz tuning fork on your palm (to make it vibrate) and place the tip on the participant's sternum (i.e., breastbone) to demonstrate.
2. Tap the tuning fork again and place it on the big toe at the metatarsophalangeal joint, with the toe supported by a finger underneath. The participant reports if the vibration is felt and the sensation is similar to the sternum.
3. To be rated normal (0), the participant should report a similar vibration to the sternum. If the participant feels nothing, score = 3.
4. If the participant reports some vibration but less strong than the sternum, tap the tuning fork again and place it on the ankle.
5. If vibration is perceived at the ankle, score = 1.
6. If the participant reports some vibration but less strong than the sternum, tap the tuning fork again and place it on the knee. If vibration is perceived at the knee, score = 2.
7. If the participant reports less strong sensation at the knee, score = 3.

Position sense

1. Demonstrate the test on the thumb first, before testing the big toe. Before conducting this test, place the foot of the participant on a table below knee level. Before attempting the test, the big toe should be flexed and extended (up, down and middle plane) multiple times while the participant has their eyes open to demonstrate.
2. Ask the participant to close their eyes. Hold the big toe from the sides. Ask the participant to report whether the toe is 'up' or 'down' when you move it in the respective direction using the other hand. Test three times.

3. To be rated normal (0), the participant should report the correct direction at least 2 out of 3 times.
4. If incorrect twice or more at the toe (either the participant does not know the direction or chooses the incorrect direction), repeat the test at the ankle. Hold the ankle from the sides. Using the other hand, move the foot up or down. Test three times. If the participant reports the correct direction at least 2 out of 3 times, score = 1.
5. If incorrect twice or more at the ankle, repeat the test at the knee three times. If the participant reports the correct direction at least 2 out of 3 times, score = 2, otherwise score = 3.

See below for scoring (enter into tablet). If the participant scores 4 or more, please refer them to the local area hospital for confirmatory diagnosis.

Table 4: Scoring scheme for mTCNS neuropathy examination

<table>
<tr><td colspan="3">NEUROPATHIC SYMPTOMS SCORING</td></tr>
<tr><td>Symptom</td><td>Score (0-3)</td><td>Scoring</td></tr>
<tr><td>Foot/leg pain</td><td></td><td rowspan="8">0 = Absent

1 = Present, but no interference with sense of well-being or activities of daily living

2 = Present, interferes with sense of well-being but not activities of daily living

3 = Present and interferes with both senses of well-being and activities of daily living (both)</td></tr>
<tr><td>Foot/leg numbness</td><td></td></tr>
<tr><td>Foot/leg tingling</td><td></td></tr>
<tr><td>Foot/leg weakness</td><td></td></tr>
<tr><td>Pain/ numbness/ tingling/ weakness in hands</td><td></td></tr>
<tr><td>Unsteadiness/ sense of imbalance</td><td></td></tr>
<tr><td colspan="3">SENSORY EXAMINATION SCORING</td></tr>
<tr><td>Test</td><td>Score (0-3)</td><td>Scoring</td></tr>
<tr><td>Pin prick</td><td></td><td rowspan="3">0 = Normal (toe sensation same as test)
1 = Reduced at the toes only
2 = Reduced to a level above the toes, but only up to the ankles</td></tr>
<tr><td>Temperature</td><td></td></tr>
<tr><td>Light touch</td><td></td></tr>
</table>

		3 = Reduced to a level above the ankles and / or absent at the toes
Vibration sense		0 = Normal (toe sensation same as test) 1= Reduced at the toes, but normal at the ankles 2 = Reduced at the ankles, normal at the knee 3 = Reduced or absent at the knee and / or absent at the toes
Position sense		0 = Normal at toe (correct at least 2/3 times) 1= Reduced at toe, normal at ankle (correct at least 2/3 times) 2 = Reduced at ankle, normal at knee (correct at least 2/3 times) 3 = Reduced or absent at the knee
Total M-TCNS score (max 33)		Sum above symptom and sensory scores

Infrared foot photograph SOP

Summary

Infrared and visible spectrum (regular) photographs of a patient's feet might help in detection of early signs of damage seen in people with diabetes (for example ulceration). This SOP will only be conducted on people with diagnosed diabetes in the cohort (i.e. those who are also undergoing neuropathy examination). For newly diagnosed diabetes cases, we will take these photographs during the follow-up visit at the household.

Equipment needed

- CAT S61 camera phone
- Phone charger for CAT S61
- Damp cloth for cleaning for the feet
- Dry cloth for drying the feet after cleaning
- Plain cloth for creating plain backdrop for photograph (with two slits or semi-circles cut in bottom to allow it to fully cover background behind ankles)
- Tablet (for completing questionnaire to confirm that photos were taken correctly)
- Surgical bed OR two chairs (one for sitting and another for resting feet upon).

Preparation

- Make sure the CAT S6 camera phone is charged and in working order.
- Although not strictly necessary, it may be useful to adjust the alignment between the infrared and visible spectrum image (if the alignment is not good). To do this, set-up a shot of feet as per this SOP, then click on the spectrum button and adjust the sliding bar until the white edges line up with the infrared image (see figure 3 below, and 00:30s-00:50s in this video: https://www.youtube.com/watch?v=iSa8oQ7ZbwM&t=34s). This should only need to be done occasionally, if correctly aligned initially.

Preparing the participant

- Check that the participant has been resting in a **seated position with legs facing** down for at least **15 minutes** before the photographs are taken. Normally, this SOP will be conducted directly after the USCOM and neuropathy have been done.

Steps

1. Once rested, begin protocol by asking the patient to lie down flat on a bed OR lie their legs flat by putting their feet up on a chair/footstool the same height as their seat. Make sure they are comfortable.
2. As the patient is lying down, ask them to first touch their ankles together, and then gently lift the feet to separate them by about 1 cm so that no parts of the feet are touching (see Figure 1).
3. Ask the patient to flex their feet so that they form a 90-degree angle with the bed (Figure 2).
4. Briefly observe the feet. If any excessive dirt or debris is visible, remove by wiping with a damp cloth. Dry the feet before proceeding.
5. Have a second person hang/drape a solid coloured sheet behind the feet as you prepare to take the picture. The sheet should hang over the calves in order to form a solid background of colour and temperature for the images when you take an image of the plantar region of the feet (see Figure 1 & 2).
6. Turn on the CAT S61 phone camera and open the infrared camera App (myFLIR), and ensure the camera is set to the regular default Infrared image capture mode ("iron", the first option). (Figure 3).

7. Position both feet in a single photo. Re-adjust the patient's feet if necessary. Capture image (example images shown left side in Fig 1). Cat S61 phone will automatically capture a visual spectrum image at the same time as the infrared image.
8. View the images to ensure entirety of both feet have been captured in the image and that the images are in focus and without blur.
9. Press on the share icon, and then "FLIRtools" (middle bottom). Then two options depending on Wi-fi availability:
    a. If no Wi-fi available, press the PDF icon in bottom left. Once the PDF with both regular and infrared image is loaded, press download and name the file with the participant ID. VERY IMPORTANT TO ENSURE CORRECT ID IS ENTERED. Then press the three dots icon in top right, and press "download" again, to download the PDF to the phone (for transfer to laptop at the end of the day).
    b. If Wi-Fi is available, then you can simply directly save each jpg image (infrared and then the normal one, switch between them by pressing arrow top right) via the share button at the bottom right (to google drive or email). VERY IMPORTANT TO ENSURE BOTH JPG FILES ARE LABELLED CORRECTLY WITH PARTICIPANT ID (PID_v (normal photo), PID_ir (infrared photo)).
10. Make a note on the ODK form that both photographs have been correctly taken and the time (in case needed for identification later), and also the method of saving used above (i.e. single PDF or separate JPG files).

Figure 7: Example feet images. Thermal image on left, phone camera image on the right.

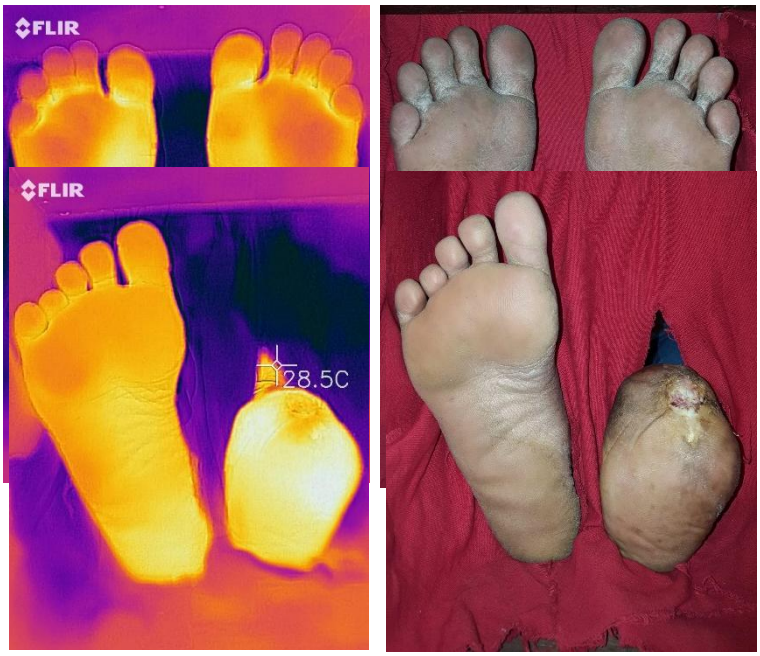


Figure 9: Orientation of solid-coloured sheet, feet, phone and IR camera.

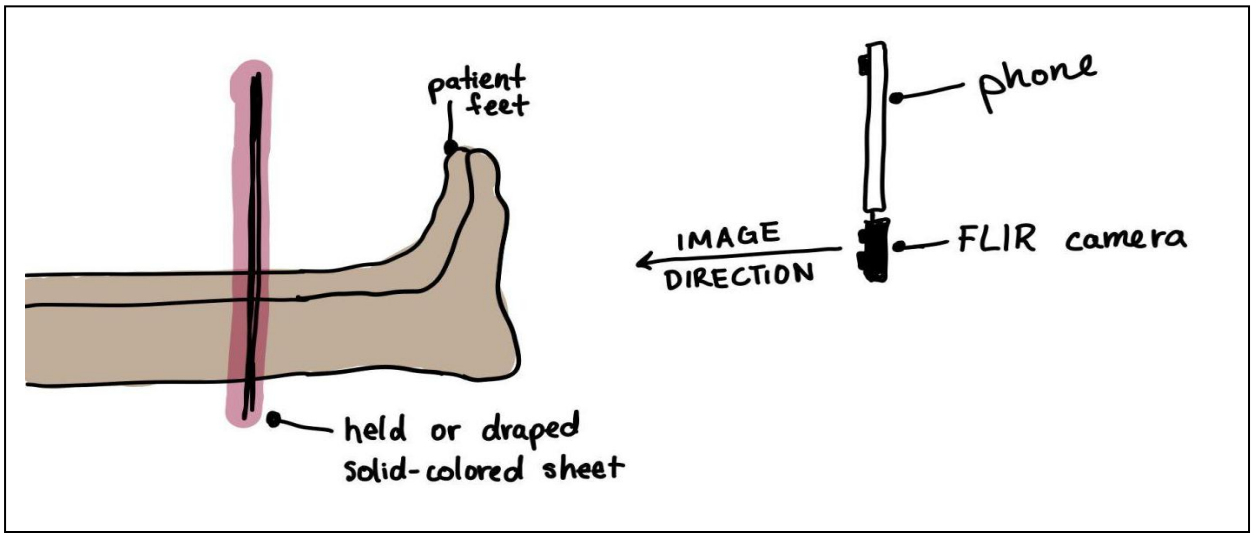


Figure 8: Image capture screen in CAT S6 camera, including how to adjust the IR/ visual overlay.

Data transfer:

1. At the end of the day, take the CAT S6 phone back to the office (NIN) and put to charge. If files were not sent by Wi-fi during the day, use a USB cable transfer all photos from the phone's download folder to the appropriate folder on the NIN hard-drive. If files were sent to google drive, extract the files from here and save into appropriate folder on NIN-hard drive.
2. Conduct double check to ensure all the expected participant IDs are present from that day, and no clear errors in the photographs taken.

Fundus imaging SOP

Summary:

Participants will have images of their retina taken using a non-mydriatic fundus camera. This will not require pupil dilation. Three photos of each eye will be taken: one of the anterior and two of the posterior (one centered on the macula and another centered on the optic disc) (six images in total per person). Evaluation of the images will be conducted at a later date, after the clinic. All participants are eligible for retinopathy screening (regardless of diabetes status).

Equipment:

- Bosch Eye camera (non-mydriatic fundus camera) with anterior and posterior modules
- 1 high backed chair for participant
- 1 chair with wheels for fieldworker
- Target (any image or mark where the participant can focus on)
- Notebook to record image serial numbers and participant IDs
- Laptop
- Materials to darken room

Preparation:

- Ensure equipment is fully functional and charged
- Clean eye cup with alcohol wipe between each participant
- Darken the room as much as possible (turn the lights off, keep the laptop outside of the room, cover windows or any other sources of light with thick opaque material)
- Amend camera settings to:
    - Mark which eye was imaged
    - Not capture low-red and red-free images
    - Allow instant review of images
    - Focus automatically (this can be amended to manual focusing if image is not clear)
- Setup a clear marker on a wall 2-3m behind where the fieldworker will sit
- Wear own glasses (if normally worn)
- Prepare the camera by attaching the posterior module first

Quality control

- If the image is unfocused, switch to manual focus mode and press the up and down buttons to focus the image. To help with this, you can ask the participant if they are long-sighted (i.e., cannot see objects clearly up close), in which case focus by pressing the up arrow. If they are short-sighted (i.e., cannot see objects clearly far away), focus by pressing the down arrow.
- You can adjust the flash level to improve the lighting and clarity.
- Dark or grainy photos may result from undilated pupils. Ensure there is no excess light in the room, ask the participant to cover their second eye with their hand when taking the photo, wait 1 min before repeating the image, and increase the flash level slightly
- If there is a bright crescent/pale ring/loss of contrast at the edge of the image, this may indicate incorrect positioning. Reposition the participant and repeat.
- If the is a white layer from the periphery to the center, ensure there is no excess light in the room, reduce the flash, and wait 1 min before repeating the image
- Other large artefacts may result from the participant blinking or their hair falling across the camera. Double-check these issues and repeat.
- Other artefacts (e.g., bright and dark spots) may indicate issues (e.g., dust) with the lenses. Follow the supplier instructions for these potential artefacts.
- If the participant has cataracts or opacities, it may not be possible to improve image quality. Move on to the next eye.

Prepare the participant:

- Explain that you will take a picture of both of their eyes, it will take around 5 minutes and will not hurt. They will see a quick flash like when a photograph is taken.
- Ensure the participant is seated comfortably and their back is supported by the chair
- Ensure the participant's hair is kept well away from their eyes
- Request the participant to remove glasses (if wearing them)

Steps

1. Ask the participant to look and keep focusing on the 2-3m marker behind you, even if you are moving in front of it
2. Request the participant to remain very still throughout. Double check their hair has not fallen in front of their eyes
3. Bring the camera slowly towards the eye from approximately 10cm distance. Ensure the cup that touches the eye cavity is pressed firmly so that the inner circle fits the eye ball exactly

(the silicone should be compressed approximately halfway down). Slowly adjust the position of the camera to achieve this.

4. Use your hand to stabilise the camera and the participant's head. Try to ensure that the participant does not move their head from the initial position.
5. Note down the participant ID and the serial number of all photos in the notebook
6. Turn on the aiming light by pressing the left soft key
7. Start by taking images of the right eye.
8. Ask the participant to blink before taking the photograph
9. Take one image of the right eye while the optic disc (the pale circle) is in the center of the image by pressing the shutter button. If using automatic focusing, a square will appear once the camera has focused.
10. Before moving on to the next image, check the quality of the photo by zooming in using the middle and arrow keys. If the quality is inadequate (see below), then follow quality control steps (in below section) and repeat the image.
    a. You cannot see the optic nerve or macula clearly and they are not centered
    b. The image is not focused and details (e.g., outlines of smaller blood vessels) are not clearly visible
    c. The image is very dark/shadowy, or overexposed with white light around the periphery to center
11. Wait for 1 min before taking an image of right eye with the macula (small circle of shadow with no blood vessels) centered. Check image quality and repeat if necessary.
12. Wait for 1 min before taking images of the left eye, following steps 7-9. Check image quality and repeat if necessary.
13. Once the 4 images of the posterior have been taken, remove the posterior camera module and attach the anterior module.
14. Press the middle key to select the light source (white) and select autofocus
15. Turn on the aiming light by pressing the left soft key
16. Press the cup onto the patient's eye and ask them to stare straight forwards and open their eyes wide.
17. Take one image of each eye, ensuring the eye is fully open.
18. At the end of the day, connect the camera to the laptop and transfer the images. Add the participant ID to the end of the file names ("_12345")

Tuberculosis screening and referral SOP

Summary:

Tuberculosis is a notifiable, communicable disease in India. If a patient screens positive for "presumptive TB" (as defined by the Technical and Operational Guidelines for TB Control in India: Case finding and diagnostic strategy[4]), they should be referred for diagnostic testing. We will share their contact details with their ASHA worker (with their consent) to support them during testing and treatment. We will contact the participant and/or the ASHA worker later to (a) confirm whether they went for testing, and (b) request information on their diagnosis.

Steps (in the clinic)

1. If the respondent has any symptom of presumptive TB (cough for 2 weeks+, fever for 2 weeks+, significant weight loss, any blood in sputum in past 6 months, drenching night sweats[5]), the tablet will notify you that the respondent has screened positive for potential TB.
2. Explain to the respondent that their symptom(s) mean that they could have TB and it is important for them to be tested to confirm whether they do. If concerned, explain that testing usually only involves giving a sputum sample and they can receive this and treatment for no cost at a government facility.
3. Inform the respondent that you would like to pass their name and address to their local ASHA worker, who will contact them directly and help them arrange testing. Be clear that we will not share this information with anyone outside of their ASHA worker.
4. If the respondent does not wish for us to pass on their information to an ASHA worker, strongly recommend that they attend a healthcare facility themselves and inform them that we will visit their household in the next few weeks to confirm the results of the testing. Ask them to keep their records so we can check these.
5. Continue with the questionnaire once you have discussed the diagnostic testing.

Steps (at NIN)

1. Towards the end of data collection in a village, the study manager will identify cases of presumptive TB in the dataset.
2. For all respondents that gave consent to contact their ASHA, a fieldworker will contact the relevant ASHA worker to inform them of the presumptive TB cases in the village, share the

[4] https://tbcindia.gov.in/showfile.php?lid=3216
[5] https://tbcindia.gov.in/showfile.php?lid=3216

contact details, arrange for the ASHA to support each person to be tested, and to request to be informed once the respondents have been tested.

3. Once the ASHAs share that the participants have been tested, a fieldworker will contact the participant for information on the diagnosis.
4. For all respondents that do not give consent to contact their ASHA, a fieldworker will contact the participants in the following 2-3 weeks following the clinic for information on their testing and diagnosis.
5. Participant follow-up can be in person or via phone and fieldworkers should request to see healthcare records as confirmation (e.g., to send a picture via WhatsApp when feasible).

Dementia screening and referral SOP

Screening summary

Dementia screening aims to identify individuals with mild cognitive impairments or dementia. The dementia screening section includes sets of questions (brief CSI-D - designed for low education populations) that test different components of their cognitive reasoning and include short tasks (e.g., to remember words). If CSI-D scores indicate potential cognitive impairments, an informant interview will be conducted (using the CSI-D informant questionnaire) with a carer/close household/family member at the household during sample collection.

Only participants aged 45+ are eligible for dementia screening.

Guidance for interviewers:

- Some participants may be discouraged by their mistakes, and even not want to continue. Under these circumstances, stress that mistakes are normal and to be expected. No one gets all of the questions right and this is the purpose of the test. Do encourage them to continue, and don't accept refusals too easily.
- People with dementia (there will likely be few) may have real difficulties with these tests. You should nevertheless try to persevere and complete the tasks. There may be two exceptions:
    - Participants may have such severe dementia that they do not understand what is being asked of them, and/ or give either no response or apparently more or less random responses to all questions. In this case (an interviewer judgment) there is no point in persevering.
    - Occasionally people with early dementia (who are aware of their limitations) may show a 'catastrophic' i.e. angry reaction to being tested, for example accusing the interviewer of

asking ‘stupid questions’ or of insulting them. Under these circumstances it would be unwise to push too far.

Preparation:

- The questions will cover the following topics and the participant’s response will be graded as correct or incorrect. Before the start of the clinic, ensure you know the correct answers:
    - Where the local market/store is
    - The day of the week
    - The season
        - Decide among the field team what an appropriate response is before the clinic
        - At periods where the season is changing multiple responses can be marked as correct (e.g., summer / monsoon).

Prepare the participant:

- Explain that you will ask some more questions and ask them to follow a few instructions, that the questions and instructions may seem weird, but they should respond anyway.
- Make it clear that nobody gets them all right and they should not worry if they think they have got an answer wrong.

Steps:

1. Introduce the dementia questions and move through each question and task, scoring the participants’ responses as correct or incorrect.
2. If the interview is stopped early (see above) then code all of the remaining variables as answered incorrectly. If there is no response, a don’t know, or a meaningless response during the course of the interview, whether because of deafness, other communication problem, or dementia, then code the question as answered incorrectly.
3. If a participant wishes to revise their response to a cognitive item, unprompted, then check that they are sure they wish to change their answer, and code the new answer (whether it is correct or incorrect).

Informant interview

Summary

For participants that screen positive for mild cognitive impairments and dementia (CSI-D score ≤7), we will request to conduct the CSI-D informant questionnaire with their carer or a close household/family member. This will take place at the household during sample collection.

Preparation

- The data quality/medical referrals R script will be run on the weekly ODK dataset before the day of data collection. This will identify the ID numbers for participants with CSI-D scores ≤7.
- The study manager will provide this list to the APCAPS fieldworkers attending the households during sample collection.

Steps

1. During household-based data collection, explain to the primary APCAPS participant (with the CSI-D score ≤7) that you would like to ask some very short questions to someone who knows them well (most likely a household and/or family member). These questions will be used to better understand some of the responses they provided in the main interview.
2. If the main participant is willing, ask them to identify who the best respondent would be, preferably someone that is available in the household.
    a. If no-one is available at that point, ask them when would be best to return for the interview and inform them that you will return to the household to do the interview with their family member.
3. Once the best respondent has been identified, approach them and explain the participant information sheet and respond to any relevant questions. If they consent to participate, explain the consent form and request their signature/thumbprint if literate (under observation by a literate witness).
    a. If they do not wish to participate, thank them for their time and discuss with the primary APCAPS respondent whether anyone else would be a suitable interviewee. If none are identified, thank them for their time and skip the CSI-D questionnaire.
4. Once written consent has been provided, complete the CSI-D informant questionnaire with the interviewee. The interview should be conducted without the primary APCAPS participant present.
5. Ensure that the main APCAPS participant's ID number is entered correctly into the ODK questionnaire so that the responses can be linked.

Vocal biomarkers SOP

Summary:

The way that people speak (e.g., the number of pauses they take) or the sound of their voice can be used to identify underlying health issues such as mental health, neurological or respiratory conditions. To be able to identify these changes, we plan to record the participant's voice. We will record the participant undertaking three different tasks: (1) speaking freely for 20 seconds, (2) holding a long vowel sound ('aaa'), and (3) (ages 45-plus only) naming as many animals as possible in 1-minute. The animal naming task can also be used to assess cognitive health. These recordings will later be analysed to identify signs of underlying health conditions. For the free speech task, the recording should be of participant's voice rather than the interviewers, though some encouragement and probing by the interviewer may be necessary to ensure the free speech continues for an adequate time (minimum 20s recording).

All participants are eligible to participate in the free speech and vowel sound audio-recordings. Only participants aged 45-plus are eligible to participate in the animal naming task.

Equipment:

- Boya BYM1 Omnidirectional Lavalier Condenser Microphone.
- ASUS AI Noise-Cancelling Mic Adapter connected to laptop.
- Tablet with ODK disability questionnaire uploaded.
- Stopwatch

Preparation:

- Setup the microphone with the noise cancelling adaptor on the laptop in the clinic before you start. Test that the microphone is working at the start of the clinic. Aim to conduct the audio-recordings in a quieter part of the clinic.
- In the audio-recordings folder on the laptop, create a new sub-folder and rename it with the participant's ID.
- Four audio-recordings will be saved into this folder, (1) free speech, (2) long vowel sound, (3) animal naming (45-plus) and (4) breathing (SOP below).

Prepare the participant:

- Explain that you would like the respondent to repeat a few sounds for you to record on the microphone. Inform them that these recordings will be private and not linked to their names or

anything identifiable. The recordings will be used by scientists to find a technological way of identifying different health issues from people's voices. Only continue with the recordings if they give their permission.

- For the free speech task, explain to the participant that you would like to record them speaking for around 20 seconds. What they talk about is not important and they are not being examined on it in anyway. We are interested in the way they speak as a recording of their voice could be used to identify underlying health conditions.

Steps:

1. If the respondent gives permission to have the session recorded, pass the microphone and ask them to hold it close to their face (around a 10cm distance) throughout the task.
2. The first task is the held vowel sounds.
3. Ask the participant to make the 'aaa' vowel sound for 5 seconds, and to repeat three times. Ensure the participant is able to catch their breath between each sound by leaving a gap of at least 3s between each.
4. The sound should be held for the full 5s (not repeated like a-a-a-a-a), use your fingers to silently count the 5 seconds.
5. Press stop after each vowel sound if complete.
6. The next task is the free speech task.
7. Start the recording on the ODK questionnaire, and ask the participant
    a. "Can you tell me about what you did yesterday from the moment you woke up to when you went to bed. Please think about the food you ate, people you saw and spoke to, where you went and the activities you did. Let's start with when you woke up…"
8. If the participant is unsure and does not start speaking, leave it 10 seconds, and re-explain the purpose of the task and that it is not important what they speak about. They can choose another subject if they prefer.
9. Give non-verbal encouragement as they speak, for instance nodding, eye contact, positive and encouraging facial expressions.
10. Observe the microphone and ensure it does not drop/move while they are speaking. If it does, move it back to the initial position 10cm away from their mouth.
11. Keep an eye on the time, if the participant stops before 20 seconds ask short probing questions to encourage them to continue (e.g., "what did you do then?", "where are they now?").

12. If the recording reaches 40 seconds, look for an appropriate break in the story to inform them that they can stop and thank them. Avoid abruptly stopping their flow, particularly if they are talking about anything sensitive.
13. Press stop.
14. For those aged 45-plus, the next task is the animal naming.
15. Explain to the participant that you would like them to name as many animals as they can think of in one minute. They can include birds along with animals. With their permission, you will record the activity.
16. Start the recording on the ODK questionnaire and then press the stopwatch.
17. Count categories of animals (e.g., dogs), as well as specific types (e.g., Doberman, Shepherd) as correct. Any members of the animal kingdom, real or mythical, are scored as correct, except repetitions and proper nouns (e.g., Mickey Mouse).
18. You may wish to note down the count in a tally in a notebook. If the participant states the same animal/bird twice or more, only count it as one. If they name something that is not an animal/bird, do not count it.
19. If the participant stops before the end of the minute, encourage them to try to name more animals. If there is a silence of about 15 seconds, prompt them to continue by asking "Anything else?" or repeat the basic instructions.
20. Stop the stopwatch at one-minute and press stop on the recording.
21. Enter the total number of animals and/or birds stated by the participant into the questionnaire, and note whether they repeated any animals or named anything that is not an animal/bird.

Breath recording SOP

Summary

People's breathing patterns can also be assessed to identify underlying respiratory conditions. We will record the sound of the participant breathing (5 breaths) **without the noise cancellation adaptor**. All participants are eligible to participate in the breath recording.

Equipment

- Boya BYM1 Omnidirectional Lavalier Condenser Microphone
- Tablet

Preparation

- The breath recording will be conducted on the laptop **with the noise cancellation adaptor removed.**

Prepare the participant:

- Explain that you would like to record the sound of the participant's breath using the microphone held close to their neck. Only conduct the recording if the participant gives verbal consent.

Steps

1. Ask the participant to hold the microphone so that it directly touches the front of their neck over the trachea (you may have to show them the correct position) and ask them to hold it still during the task.
2. Press record on the relevant question, and ask the participants to take a deep breath through their mouth and then exhale normally (not a forced or slow exhale) through their mouth. Ask them to repeat the cycle again for 5 cycles.
3. Using your fingers, silently count each cycle and indicate when they should stop. Press stop once the 6th cycle is complete.

Echocardiogram (2D-ECHO) SOP

Summary

2D -Echocardiogram is a diagnostic test which uses ultrasound waves to make images of the heart chambers, valves and surrounding structures. It can measure the hemodynamic parameters of the heart like systolic and diastolic functions, cardiac output, valvular stenosis and regurgitations and is a sensitive test to find fluid around the heart (pericardial effusion).

Person Responsible

- Technician trained in 2D - ECHO measurement

Equipment

- Philips – CX50 Potable 2D-Echo machine
    - Philips – CX 50 Portable 2D Echo – Doppler Machine
    - Power cord
    - 2D-Echo doppler Probe (S 5-1 PureWave Cardiac Sector)
    - Carotid Probe (L12-3 Lenier)

    - Liver ultrasound Probe (C 5-1 PureWave Convex)
    - UPS – 1 KV
- Laptop / All in one (requirement: Windows XP, Vista, Windows 7, 8/8.1, 10 (32 or 64 bit) operating systems)
- Examination Table with mattress
- Hanger for clothes
- Safety razor/Trimmer
- Pillow
- Self-adhesive electrodes- 3 for Each patient
- Alcohol hand gel
- Disinfectant wipes
- Tissue Paper
- Disposable sheet

Preparation

- The assessor or authorized personnel is responsible for ensuring that a 2d Echo is required by the study protocol and also to ensure that a specific machine is being utilized as stated in the protocol.
- The 1 KV UPS will be connected to the power socket available in the field. The Philips CX-50 Portable Ultrasound/Echo Machine will be connected to the UPS using power cord.
- On starting the machine there will be an indication to add the patient's details. The subject's details are entered in the machine as per the voluntary ID and alternate family ID number. Subject's name will be entered in the frame of first letters of the name and sir name. For example, B. Tulasi Kumar will be entered like BTK.

Steps

1. Make sure that room temperature is comfortable (not too cold too hot).
2. Make sure the individual has relaxed for 5 to 10 minutes before recording, laying him/her on couch.
3. Inform patient of need for the test and obtain verbal consent after explaining the procedure. Explain that procedure is not uncomfortable or dangerous and can be conducted in every person including people with pacemakers.
4. Ensure patient that the 2D Echo of takes the ultrasound images of the heart and does not involve the use of electricity or radiation.

5. If there is a female participant a female attendant either from her family or any female member form the staff must be present to carry out the procedure.
6. It is preferable that the chest to be free of hair or should be minimal so the it won't be interfering with sticking of electrodes and it will be painful to remove the electrodes if they are stick on the hair.
7. If the hair on the chest is more, the participant is provided with a razor or trimmer depending on their preference and requested to remove the hair.
8. Plug in and connect the 2D Echo machine to the UPS and check that machine is working as per manufacturer's instructions.
9. Connect the 2D Echo Doppler Probe (S 5-1 PureWave Cardiac Sector) to the machine and see the confirm the sector.
10. Connect the 3 lead ECG cable to the Machine.
11. Ask participants to loosen or remove the top half of their clothing (shirts or blouses) to allow access to the chest; Women may keep their brassiere if they prefer.
12. The participant will lie comfortably on the bed/couch in the supine position and the ECG leads will be stick to the participant.
13. 3 self-adhesive electrodes will be stuck to the patient's:
    1) Right upper chest
    2) Left upper chest and
    3) Left lower chest
14. Ask the participant to turn to the at left lateral position keeping the left arm beneath the head. Ask participants to relax and not to take heavy breathes.

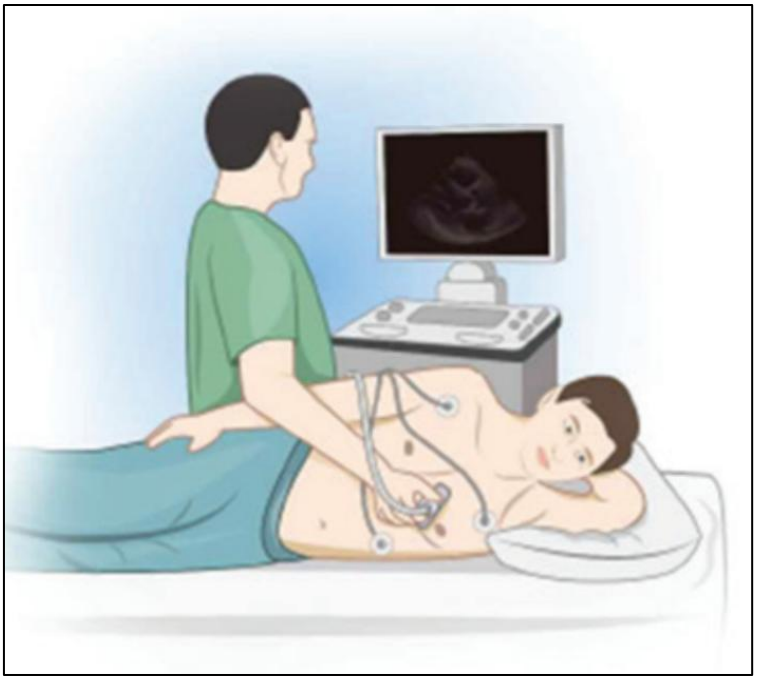


Figure 10: Diagram of the participants position during the Echocardiogram

The 2D Echocardiogram views will be obtained the following order

1) Parasternal Long Axis (PLAX)
2) Parasternal Short Axis (PSAX)
3) Apical 4 – Chamber (A4C)
4) Apical 5 – Chamber (A5C)
5) Apical 2 – Chamber (A2C)
6) Apical 3 – Chamber (A3C)
7) Sub costal (SC)
8) Supra Sternal (SSN)

Table 5: Echo views and Parameter Recording: The following DICOM, Cines and stills will be captured during the Echo examination as detailed below

Image	Image_type	Location	Modality	Comments	Optional
1	Cine	PLAX	2d		
2	Cine	PLAX	2d with color	Color over the mitral and aortic valve	
3	Still	PLAX - LA level	m-mode		
4	Still	PLAX - LV basal	m-mode		

5	Cine	PSAX - aortic level	2d		
6	Cine	PSAX - aortic level	2d with color	Color over tricupid valve	
7	Still	PSAX - aortic level	CW doppler	CW RV inflow	
8	Cine	PSAX - LV basal level	2d		
9	Cine	PSAX - LV mid level	2d		
10	Cine	PSAX - LV apical level	2d		
11	Cine	AP4Ch	2d		
12	Cine	AP4Ch	2d with color	Color over mitral valve	
13	Still	AP4Ch	PW doppler	PW LV inflow	
14	Still	AP4Ch	CW doppler	CW Mitral Regurgitation	If pathology on color
15	Still	AP4Ch	CW doppler	CW Tricuspid Regurgitation	
16	Still	AP4Ch	Tissue dopler - LV basal septum		
17	Still	AP4Ch	Tissue dopler - LV basal lateral wall		
18	Cine	AP5Ch	2d		
19	Cine	AP5Ch	2d with color	Color over aortic valve	
20	Still	AP5Ch	LVOT PW doppler		
21	Still	AP5Ch	AV CW doppler		
22	Still	AP5Ch	PW doppler	PW Aortic Regurgitation	If pathology on color
23	Cine	AP2Ch	2d		

24	Cine	AP3Ch	2d		
25	Still	Apical views		Calculation of GLS using all three apical views	

Table 6: Recording of the parameters: The following parameters will be recorded as a minimum for all patients, based on the pre-recorded DICOM images (i.e. to be done at a later date to save time during clinic).

View	**Type**	**Echo parameters**	**measurement**
none	Patient	Weight	anthropometry
none	Patient	Height	anthropometry
plax	LV	LVEDD	2d
plax	LV	LVESD	2d
plax	LV	IVSD	2d
plax	LV	LVPWD	2d
plax	LA	LA AP diameter	2d
plax	LV	LVOT	2d
plax	Ao	Sinus of Valsalva	2d
plax	Ao	ST junction	2d
plax	Ao	Aortic anulus	2d
a4c	LV	LV_volume_4C_systole	2d
a4c	LV	LV_volume_4C_diastole	2d
a2c	LV	LV_volume_2C_systole	2d
a2c	LV	LV_volume_2C_diastole	2d
a4c	LA	LA volume_4C	2d
a2c	LA	LA volume_4C	2d
a4c	LA	LA _volume	2d
a4c	LV	GLS_4C	gls
a2c	LV	GLS_2C	gls
a3c	LV	GLS_3C	gls
bulls_eye_plot	LV	GLS	gls
a4c	MV	Awave	pwd

a4c	MV	Swave	pwd
a4c	MV	EA ratio	pwd
a4c	MV	DT	pwd
a4c	MV	VTI	pwd
a4c	MV Regurgitation	none, mild, moderate, severe	cfd
a4c	Tissue doppler	e_prime_septal	tdi
a4c	Tissue doppler	e_prime_lateral	tdi
a4c	Tissue doppler	s_wave	tdi
a5c	AV regurgitation	none, mild, moderate, severe	cfd
a5c	AV	avmax	cwd
a5c	AV	avmean_gradient	cwd
a5c	AV	avmean_vel	cwd
a5c	AV	av_vti	cwd
a5c	LVOT	vmax	pwd
a5c	LVOT	vti	pwd
a4c	RV	basal_rv_diameter	2d
a4c	RV	mid_rv_diameter	2d
a4c	RV	rv_length	2d
a4c	RA	ra_area	2d
a4c	TR	trace, mild, moderate, severe	cfd
a4c	TR	vmax	cwd

Important aspects in Echo recordings:

- Ask the subject to breathe normally, relax, and remain still.
- Acquire the views of Echo Loops and all the views are ECG synchronized.
- At least 6 consecutive beats are acquired for each view.
- When the recording is satisfactory the Echo Loops are saved.
- For acquiring the sub costal view, the participant is advised to turn to supine position.
- For obtaining the suprasternal view, the participant is advised to put the pillow beneath the shoulders and extend the neck.

- Mitral and Tricuspid velocities are also recorded and saved with the sweep speed of 25 mm per second while the participant is advised to take deep inspiration and expiration in order to record the respiratory variations,
- The GLS is acquired in 3 views i.e. A4C, A2C and A2C views using QLAB software which is in built for Philips CX50 machine.
- Remove lead wires and electrodes from the subject once the recording is over. Adhesive swabs or a warm, moist washcloth may be used to remove the adhesive gel from the skin.
- All the Echo recording including loops and measurements saved are being transferred to USB drive/ DVD drive and handed over to the APCAPS team on the same day.

Protocol to be followed for the participants found abnormalities in Echo:

- Any abnormal findings in the Echocardiogram will be identified and recorded thoroughly and a report with a cardiologist's signature will be provided to the participant and the nature of the abnormality will be explained in their own language and advised to meet a nearby physician or a cardiologist at the earliest. The abnormal condition found in the Echo will never be prognosticated or management options will never be disclosed or discussed by any member or the ENACT or APCAPS team in the field.

Carotid intima-media thickness test (CIMT) SOP

Summary

The carotid intima-media thickness test (CIMT) is a measure used to diagnose the extent of carotid atherosclerotic vascular disease. It is a real- time imaging tool, is a readily available, inexpensive, fast, safe, and non-invasive diagnostic procedure. The test measures the thickness of the inner two layers of the carotid artery—the intima and media—and alerts physicians to any thickening when patients are still asymptomatic. Carotid IMT is measured using ultrasound machine using Lenier phase array probe with frequency between 7 to 15 MHz. CIMT can be accurately utilized as a marker of atherosclerosis development in the setting of various risk factors, or as a predictor of cardiovascular and stroke events in daily clinical practice. Automated edge detector programs, instead of manual measurements, have made measurements faster and less variable. Based on some large population studies, normal CIMT values were defined. CIMT above the 75th percentile of average for the age, gender and ethnicity or absolute thickness more than 1.0 mm are considered an abnormal result, and people with IMT in less than the 50th percentile are classified in the low-risk group.

Person Responsible

- Technician trained in Carotid IMT measurement

Equipment

- Philips – CX50 Potable 2D-Echo machine
    - Philips – CX 50 Portable 2D Echo – Doppler Machine
    - Power cord
    - Carotid Probe (L12-3 Lenier)
    - UPS – 1 KV
- Laptop / All in one (requirement: Windows XP, Vista, Windows 7, 8/8.1, 10 (32 or 64 bit) operating systems)
- Examination Table with mattress
- Hanger for clothes
- Pillow
- Disinfectant wipes
- Tissue Paper
- Disposable sheet

Preparation

- The assessor or authorized personnel is responsible for ensuring that Carotid IMT study protocol and also to ensure that a specific machine is being utilized as stated in the protocol.
- The 1 KV UPS will be connected to the power socket available in the field. The Philips CX-50 Portable Ultrasound/Echo Machine will be connected to the UPS using power cord.
- On starting the machine there will be an indication to add the patient's details. The subject's details are entered in the machine as per the voluntary ID and alternate family ID number. Subject's name will be entered in the frame of first letters of the name and sir name. For example, B. Tulasi Kumar will be entered like BTK.

Steps

1. Procedure will be conducted directly after the 2D Echo, with initial preparatory steps as mentioned above.
2. Inform patient of need for the test and obtain verbal consent after explaining the procedure. Explain that procedure is not uncomfortable or dangerous.
3. Explain to the patient that the Carotid IMT takes the ultrasound images of the carotid artery and does not involve the use of electricity or radiation.

4. If there is a female participant a female attendant either from her family or any female member form the staff must be present to carry out the procedure.
5. Ensure the 2D Echo machine is attached to UPS and working as for previous assessment.
6. Attach Lenier Phased array probe (L12-3) to the machine to carry out the procedure.
7. The participant is asked to lie down supine and a pillow is kept beneath the shoulders to facilitate the neck extension.
8. Participant's neck is extended and gel is applied on the probe and kept on right side of the neck followed by the left.
9. Working on right side, scan the whole carotid area, first transversally to view the trachea, thyroid, jugular vein and carotid artery.
10. Carotid is visualized in short axis and identified as pulsatile structure by using pulse wave doppler.
11. Then the probe is rotated 90˚anti clock wise to view it as a parallel structure beside the jugular vein. Place probe to get clear image of the common carotid artery and bifurcation. Ensure that the probe is placed at an adequate depth so that it includes 10mm distal to the bifurcation and 30-40mm proximal to the bifurcation (i.e. common carotid artery, CCA). Both near and far walls should be clearly visible. See both figures below.
12. Save a 3-5 second CINE loop at the same probe position (i.e. including bifurcation and common carotid artery).
13. Philips QLAB software is applied to get the Carotid IMT automatically.
14. Accuracy of more than 95% is accepted as the result.
15. Export the saved loop in DICOM format to the hard drive provided with the specified ID.

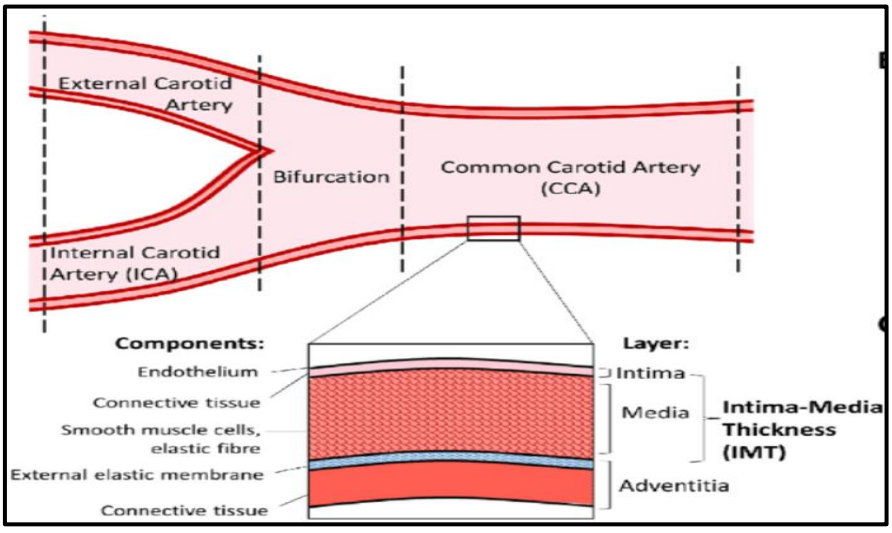
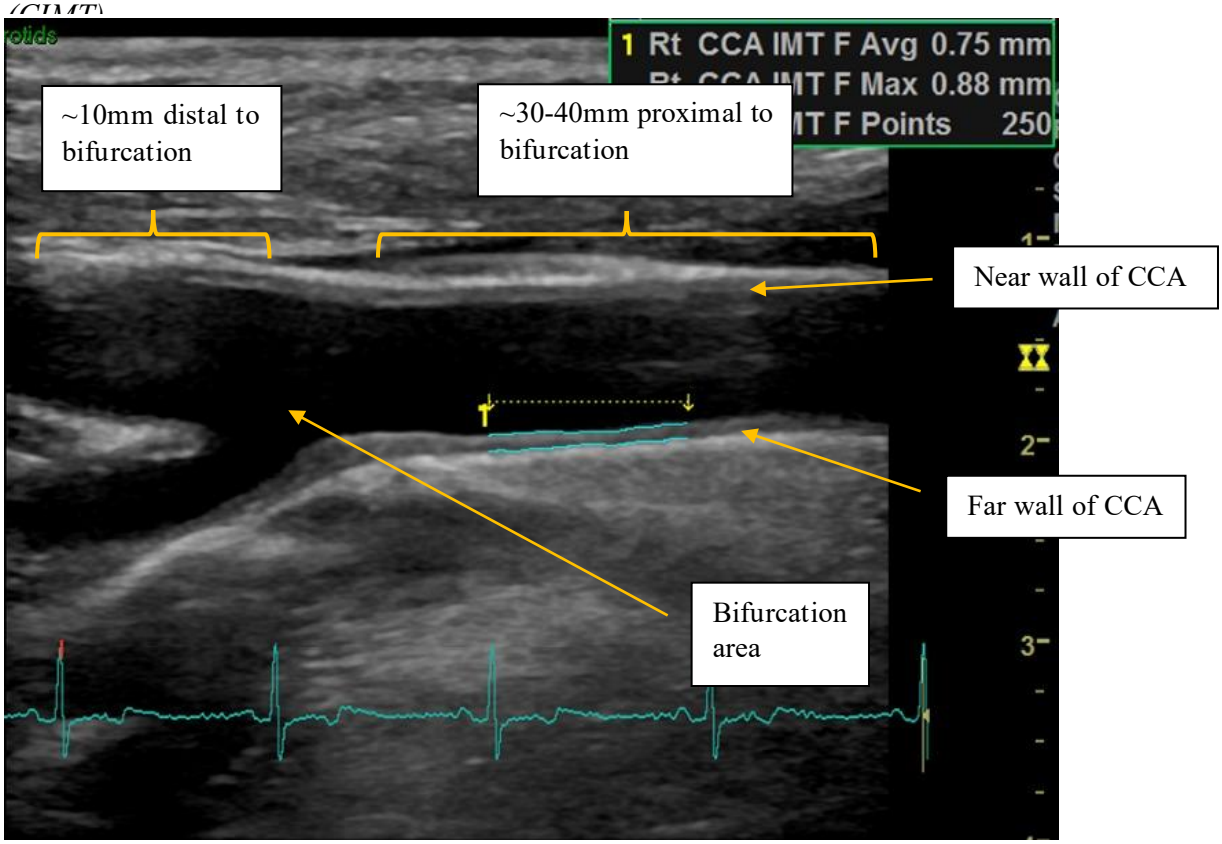


Figure 11: Schematic diagram showing the place to obtain carotid IMT (CIMT)

16. The gel is wiped off with the tissue papers and alcohol skin disinfectant is applied at the examination site once the imaging is over.
17. Repeat the procedure on the left sided carotid IMT, including exporting the same 3-5 second CINE loops (covering CCA and bifurcation) and recording the QLAB automated IMT measurement result.

Figure 12: Example still from the loops to be acquired of the Carotid IMT (CIMT)



Liver ultrasound – SOP

Summary

Liver ultrasound uses the sound waves projected on to the liver which will be converted to the images by the ultrasound machine. It will give a clear structural information of the liver and surrounding structure like biliary tree and gall bladder. It is especially useful in the diagnosis of fatty liver either alcoholic or NASH, cirrhosis of the liver as we as other congenital or acquired abnormalities like haemangiomas, mass or gallstones. The main focus of the liver ultrasound in our study is to grade the fatty liver disease and to note any gross structural abnormalities.

Person Responsible

- Technician trained in Liver Ultrasound measurement

Equipment

- Philips – CX50 Potable 2D-Echo machine
    - Philips – CX 50 Portable 2D Echo – Doppler Machine
    - Power cord
    - Liver ultrasound Probe (C 5-1 PureWave Convex)
    - UPS – 1 KV
- Laptop / All in one (requirement: Windows XP, Vista, Windows 7, 8/8.1, 10 (32 or 64 bit) operating systems)
- Examination Table with mattress
- Hanger for clothes
- Pillow
- Disinfectant wipes
- Tissue Paper
- Disposable sheet

Preparation

- The assessor or authorized personnel is responsible for ensuring that study protocol of Liver Ultrasound and also to ensure that a specific machine is being utilized as stated in the protocol.
- The 1 KV UPS will be connected to the power socket available in the field. The Philips CX-50 Portable Ultrasound/Echo Machine will be connected to the UPS using power cord.
- On starting the machine there will be an indication to add the patient's details. The subject's details are entered in the machine as per the voluntary ID and alternate family ID number. Subject's name will be entered in the frame of first letters of the name and sir name. For example, B. Tulasi Kumar will be entered like BTK.

Steps

1. Procedure will be conducted directly after the CIMT measurement, with initial preparatory steps as mentioned above.
2. Inform patient of need for the test and obtain verbal consent after explaining the procedure. Explain that procedure is not uncomfortable or dangerous and can be conducted in every person including people with pacemakers.

3. Explain to the patient that the imaging of the liver takes the ultrasound images of the liver and does not involve the use of electricity or radiation.
4. If there is a female participant a female attendant either from her family or any female member form the staff must be present to carry out the procedure.
5. Ensure the 2D Echo machine is attached to UPS and working as for previous assessment. Attach the Liver ultrasound Probe (C 5-1 PureWave Convex) to the machine to carry out the procedure.
6. The participant is asked to lie down supine and a pillow is kept beneath the head.
7. Participant's liver area is exposed by taking the shirts or blouse off. Female participants may be instructed to keep the brassiere if they prefer.
8. Gel is applied on to the convex ultrasound probe and put vertically on the anterior axillary line with the marker of the probe pointing upwards to visualize the right lobe of the liver.
9. Save a 3-5 second CINE loop of this view including 5-6 degrees of angulation, and ensuring that the peri-portal vasculature is visible in the image.
10. Grading of the fatty liver will be done based on these images at a later date (offline). It will be done in the following manner.
11. Any abnormalities like masses or haemangiomas are also saved and produced to the APCAPS study team for review.
12. Export the saved loop in DICOM format to the hard drive provided with the specified ID.
13. The gel is wiped off with the tissue papers and alcohol skin disinfectant is applied at the examination site once the imaging is over.

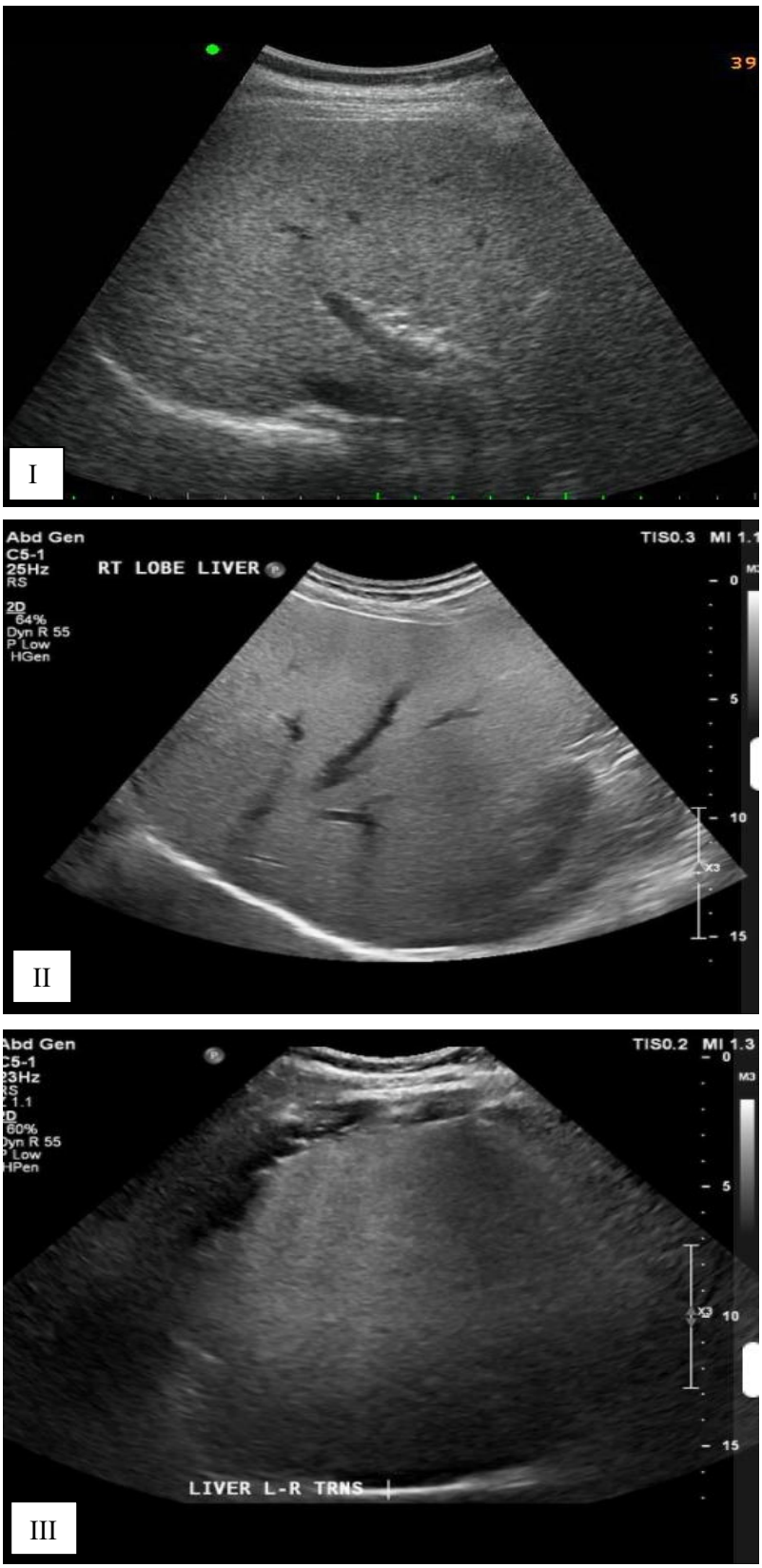


Figure 13: Fatty liver grades I-III. Grade I: diffusely increased hepatic echogenicity but periportal and diaphragmatic echogenicity is still appreciable. Grade II: diffusely increased hepatic echogenicity obscuring periportal echogenicity but diaphragmatic echogenicity is still appreciable. Grade III: diffusely increased hepatic echogenicity obscuring periportal as well as diaphragmatic echogenicity

Wearable devices (accelerometer and wearable watch for ~48 hours) SOP

Summary

All participants will be invited to take part in the wearable devices study. This will involve wearable a waist-worn Actigraph accelerometer and wrist-worn Mi-band 6 smart watch for ~48 hours, and then returning the devices to the study team. Only participants who are willing and able to carry out this protocol should take part (for example, participants who will not be available to return the devices in 2 days should not be given then; and participant who know they will not be able to wear them continuously (e.g. due to work requirements) should also not participate). If there are no available devices left, this activity can be paused until a device is returned and ready for use.
The accelerometer is a research-grade device that captures participants body movement, which can be used to derive objective physical activity information. The smart watch is a commercial-grade device which also tracks movement (although likely with lower accuracy), and contains a PPG sensor to collect pulse rate data. Among other things, we are interested in the temporal relationship between physical activity and pulse rate, which may be indicative of a person's fitness and/or predictive of future health conditions.

Equipment

- Tablet (for data logging)
- Actigraph accelerometer (charged) with waist band
- Laptop (for initialising accelerometer)
- Cable for connecting Actigraph with laptop
- Mi-band 6 (charged)
- Mobile phone (for initialising Mi-band)
- Cable for connecting mobile phone and mi-band

Preparation

- Ensure all devices are functioning and fully charged up. This will require some preparation/coordination on previous days to bring returned devices back to the office for charging.

Steps

1. Ask the participant if they would be willing to take part in the wearable device sub-study. Explain that this involves wearing BOTH a waist-worn accelerometer and a wrist-worn smart

watch for the next 2 days. These devices should not be taken off at any time, **except when bathing or showering** (the devices should NOT get wet). In approximately 48 hours' time, they will need to return the devices to the study team – the participant should be available at this time and should confirm from where the team can collect the devices.

2. If the participant confirms their willingness to participate, fill in the corresponding ODK form including the date and time that the devices are given, the serial number of each device given, and the planned date, time and location that the devices will be collected.
3. Initialise the Actigraph using the laptop, and enter the required information. Once confirmed that it has correctly initialised and device is working and charged, put the belt and accelerometer onto the participant, highlighting the correct way it should be worn. Check that the participant is comfortable and happy, and ask if they have any questions or concerns about the device.
4. Initialise the Mi-band using the linked smart phone, and enter the required information. Once confirmed that it has correctly initialised and device is working and charged, put the watch onto the participant, highlighting the correct way it should be worn. Check that the participant is comfortable and happy, and ask if they have any questions or concerns about the device.
5. Remind the participant of the date, time and location where the devices will be returned.

After the devices are returned:

1. Complete a form/log confirming the receipt of the devices from the participant and that they are in working condition. Note if they have run out of battery.
2. Take all devices back to NIN where they will be sync, wiped and charged ready for the next participant to use.
3. Plug the Actigraph into the laptop and sync the data. Ensure to label all files with the participant's APCAPS ID.
4. Plug the Mi-band into the phone and sync the data. Once completed, sync the phone with the laptop. Ensure to label all files with the participant's APCAPS ID.

Departure from clinic

Overview:

The responsibility for organising the participants' departure from the clinic lies with the study manager and/or assigned team leader. The subjects will be reimbursed for their time and loss of wages at the time of blood and urine collection (Rs. 500 per subject). Blood and urine collection will be conducted the weekend following the clinic. The participant is not obliged to provide either of these samples (they can provide both, one, or neither) but the fieldworker should make the additional

benefits to the participant clear for both samples (e.g., screening for diabetes, anaemia). If the participant does not wish to provide the samples, they will be reimbursed the full amount. This will be conducted alongside reimbursement of all participants at the household and following weekend during sample collection.

Protocol:

1. Once the participant's measure checklist has been completed, they will be referred on to the designated team leader to organise their departure
2. The fieldworker should thank the participant for their time and energy and explain the next two steps (see below).
3. Allow the participant to ask any questions.
4. If they do not wish to provide either a blood or urine sample, note it in the summary sheet
5. Inform them that we would like a random small group to come back for repeat of the clinical examination in the next 2-4 weeks. They will be reimbursed the same amount for this. Note down whether they will permit to being contacted again for this repeat.
6. Thank them again for their time.

Phase 1.

- If they are willing, a trained biochemist (alongside an APCAPS staff member) will visit the village clinic on the following weekend in the morning. They will take a small (20ml) blood sample. This will be used to test for a range of things such as blood sugar and haemoglobin. Abnormal results (e.g., that indicate diabetes) will be reported back once the tests are complete.
- Ask whether they are currently pregnant or have diabetes.
    - If not pregnant or diabetic: **The participant should not eat or drink overnight (following their last meal of the day) or in the morning before having their blood sample taken, as it could affect the results. This includes drinking any tea or coffee, or eating snacks, only water is permitted.** We will purposively visit early so they do not have to wait long to eat or drink.
    - If pregnant and/or diabetic: The participant should not be asked to fast overnight for the blood sample, but should be requested to provide a sample.
- On the same morning, we will also give them a small pot and ask them to collect a urine sample and to give it to the study staff. This urine sample will be used to test kidney health and is

especially important for people with diabetes/hypertension or at risk of diabetes/hypertension. **This sample should be the first time they urinate that morning.**

- We will also ask them some short questions about their household (10 minutes maximum) at this point.
- We will call them the day before we visit their village for sampling and remind them of the need to fast and to avoid eating in the morning before sample collection.
- Reimbursement will occur after sample collection. If they choose to not provide both samples, we will provide the same day we provide reimbursement to the rest of the village.

Phase 2.

- In the month following the clinic, we will give them a report with results of their health tests once we have the blood results. This will include their blood pressure, height and weight, and their anaemia and diabetes test results. They will receive this information even if it is all within a normal range. If any of their results are abnormal, a medical officer will give them advice about their results and where they should go for confirmatory tests.

Sample collection SOP

Summary

Collection of the blood and urine samples will be conducted at a central location in the village on the weekend following the clinic by the team biochemist and phlebotomist from NIN. When departing from the clinic the participant will be informed of the upcoming sample collection. 1-2 days before sample collection, the patient will be called by a fieldworker as a reminder. A senior APCAPS field team member will attend the villages with the biochemist to help coordinate and to provide participant reimbursement.

For all subjects, a fasting blood sample and morning urine sample will be taken. **Pregnant women and people with diabetes will not be asked to fast, but blood samples will still be taken.**

Preparation:

- The study manager or another field member will prepare the list of participants from the prior week (Saturday to Friday) of data collection in the village (names, addresses, phone numbers) and share with biochemistry team on Thursday/Friday.

- Biochemistry team will design, print and attach the required labels onto the sample collection tubes and put them into pre-prepared bags for each participant (**see labelling and kit preparation section below**).
- With the field team coordinator, the biochemistry team will plan the team, location and timings of the data collection.
- On Thursday or Friday before sample collection, village helpers will distribute labelled urine collection containers (30ml) to the households being sampled.
- On the day before sample collection, a field staff member will contact the participants on the list to:
    - Inform them of the time and location of sample collection.
    - If they are eligible to fast (i.e., not pregnant and/or diabetic), request that they do not eat or drink anything (including tea or coffee, only water permitted) following their last meal the night before and in the morning of the blood collection and remind them that the blood test results will be less accurate if they have eaten/drunk anything apart from water.
    - Request that they take a urine sample in the morning using the urine collection tube provided (confirm whether they still have the tube, otherwise the team can bring spares). Ask them to follow these instructions:
        - Please collect the **first** urination of the day (this is very important)
        - Please collect 'mid-stream' urine, i.e., not the first or last part of urine that comes out.
        - Fill the tube if possible, but do not worry if you cannot collect the full tube. Make sure it is at least one quarter to one half filled.
        - Please wash hands before and after, screw the lid on the top of the bottle tightly, and place the pot into the plastic bag provided.
        - Please store the bag somewhere safe and cool until the time when the team comes to collect it.
        - If multiple people in your household are giving urine samples, please remain aware or who's belong to who to prevent mix-up.
    - Remind them of the benefits of blood and urine testing, but if they do not want to participate thank them for their time. Inform them that reimbursement is being conducted at the sample collection clinic (regardless of whether they are providing a sample).

Labelling and kit preparation:

Bar code labels will be used to label all the sample tubes, storage vials, boxes, and zip lock sample collection bags. Labels with barcodes will be printed in-house using the APCAPS label printer in NIN, Hyderabad.

Urine tubes will be labelled up on Wednesday night or Thursday and taken to the clinic on Thursday or Friday for delivery to the participant's households.

Based on the participants being visited for blood sample collection, labels will be pre-printed on Wednesday/Thursday and zip lock bags containing all the pre-labelled sample collection consumables for each individual will be prepared.

List of items and labels to be put in bag for each participant:

- Labelled vacutainers (2x 6ml red, 1x6ml purple, 1x 2ml grey)
- Labelled 2ml plain tubes pre-filled with RNAlater solution (x2, with 1.3ml RNAlater in each)
- Labelled cryovials (12x 2ml for blood aliquots, 2x2ml for urine aliquots)
- Labelled urine collection container (to be removed and distributed the day before)
- Tourniquet
- Needle
- Holder
- Swab
- Gauze/dry cotton-wool ball
- Pasteur pipette

Other equipment required but not in participant bags:

- Centrifuge machine (1 or 2 when available)
- Thermo pipette, single channel with 100-1000µl volume range
- Box of thermo pipette tips, 1000µl with filter
    - Ensure enough tips – at least five per participant
- Test-tube stand
- Gloves
- Needle destroyer and bio-waste disposal packet
- Cool-box for transportation
- Gel ice-packs (kept in deep freezer overnight)
- Racks for transporting vials safely in cool boxes
- Elastic bands for securing vacutainers in cool boxes

- Tablet

Overview of steps

1. Complete sample collection questionnaire
2. Blood collection (20ml) by trained phlebotomist
3. Urine tube collection
4. Reimbursement
    a. Everyone who participated in the main clinic will receive the full reimbursement, regardless of whether they provide blood or urine samples.
    b. Confirm their details with the tracking information and identifiable data.
    c. Once confirmed, provide the 500-rupee reimbursement and note the exchange on the reimbursement tracking sheet.

Detail of steps:

1. Questionnaire (recent illness)

Answers to the following questions are recorded on the tablet before the blood sampling.

2.1 Any illness within the last week?	[1=Yes; 2=No]
2.2 If yes, specify what illness:	Cold / Cough / Headache / Fever / Body aches / Pain / Abdomen / Diarrhoea / Vomiting / Others-Specify
2.3 (a) Was this illness or some other reason responsible for reduction in food intake over the last week?	[1=No reduction, 2=Minor reduction, 3=Major reduction]
(b) Do you have diabetes?	[1=Yes; 2=No]
(c) Are you pregnant?	[1=Yes; 2=No]
2.4 Day of last meal	[1=Today; 2=Yesterday]
2.5 Time of last meal	[Hours: minutes; 24-hour clock]
2.6 Time blood sample taken	[Hours: minutes; 24-hour clock]
Success in blood sampling	**Volume**
2.7 Red-capped tube 1	[1=No; 2=Partial; 3=Complete]
2.8 Red-capped tube 2	[1=No; 2=Partial; 3=Complete]
2.9 Purple-capped tube	[1=No; 2=Partial; 3=Complete]
2.10 Grey-capped tube	[1=No; 2=Partial; 3=Complete]

2.11 (a) Any other comments on blood sample	[1=Yes; 2=No]
(b) If yes, specify	
2.12 Urine sample collected	[1=No; 2=Partial; 3=Complete]
2.13 Urine sample already taken by participant, or taken during visit?	[1=already taken; 2=during visit]
2.14 Time urine sample taken	[Hours: minutes; 24-hour clock]
2.15 Was urine sample first morning void?	[1=Yes; 2=No]

2. Blood collection and processing

Steps:

1. Ask the subject to sit for 10 min before starting sample collection. Draw blood from the subject in the recumbent position, where possible.
2. Keep ready:
    a. 1 x holder
    b. 1 x needle
    c. 2 x red-capped vacutainers (6ml)
    d. 1 x purple-capped vacutainer (6ml)
    e. 1 x grey-capped vacutainer (2ml)
3. Extend the subject's arm, inspect and locate the vein.
4. Perform hand hygiene and put on a pair of non-sterile gloves. Use a new pair of gloves for each new subject.
5. Attach needle to the holder.
6. Disinfect the skin at the sampling site using a 70% alcohol swab for 30 seconds. Start at the centre and wipe downwards and outwards. Allow the site to dry completely (30 seconds) and do not touch the site after cleaning.
7. Apply the tourniquet, then insert the needle into the vein (30-degree angle or less). Avoid application of tourniquet for more than one minute (either release after blood flow established in step below or before withdrawing the needle at the end).
8. Insert the red-capped vacutainer 1 onto the needle. Collect blood up to the capacity line.
9. Take out red-capped vacutainer 1 and insert red capped vacutainer 2. Ensure that the tube is filled to the capacity line.

10. Take out red-capped vacutainer 2 and insert the purple capped vacutainer. Ensure that the tube is filled to the capacity line.
11. Take out the purple-capped vacutainer and insert the grey-capped vacutainer. Fill to the capacity line, if possible (or if a bit less than 2ml can be collected that is OK).
12. Withdraw the needle gently and apply gentle pressure to the site with gauze/cotton ball. Ask the participant to hold the gauze/cotton ball in place with the arm extended and raised.
13. Gently invert the purple-capped vacutainer (containing EDTA) and the grey-capped vacutainer (containing sodium fluoride) 8-10 times to mix. Do not shake vigorously.
14. Keep the purple-capped and grey-capped vacutainers in an ice-bucket (at 4°C). Process as soon as possible, no later than 45 minutes after blood collection.
15. Keep the red-capped vacutainers at room temperature, see below.
16. Needle should be destroyed by needle destroyer.
17. All bio waste from each participant should be put back into their collection kit zip lock bag and taken back to NIN for destruction.

3. Sample processing after collection

For samples from one participant:

Have ready:

- 2 x 'EDTA-RNAL' tube (2 x2ml plain non-vacuum blood collection tubes each pre-filled with 1.3ml RNAlater solution)
- 1 x 'EDTA-CBC' vial (2ml storage vial)
- 4 x 'EDTA-P' vial (2ml)
- 4 x 'S-0.5' vial (2ml)
- 2 x 'S-2' vial (2ml)
- 1 x 'NaF-P' vial (2ml)

NB:

- When aliquoting with the thermo pipette, use a fresh tip for each sample.
- Ensure that the storage vials are closed tightly after all sampling steps.

<u>Purple-capped vacutainer</u>

1. Using a thermo pipette (fresh tip), aspirate 300µl whole blood into a 2ml storage vial labelled 'EDTA-CBC'.

2. Then, aspirate 0.5ml whole blood into a 2ml tube pre-filled with 1.3ml of RNAlater, labelled 'EDTA-RNAL-1'. Mix thoroughly by inverting a few times. Repeat for the 2nd 2ml RNAlater tube, labelled 'EDTA-RNAL-2'.
3. Centrifuge the vacutainer with the remaining ~4.7ml blood at 3500 rpm for 15 min
4. Taking care not to disturb the buffy coat layer (the thin layer of white blood cells and platelets between the plasma layer [top] and red blood cell layer [bottom]), use a thermo pipette (fresh tip) and aspirate 500µl plasma into each of four 2ml storage vials labelled 'EDTA-P' ('P' for plasma).
5. Invert the remaining contents of the vacutainer to remix into ~2.7ml "whole blood".

Red-capped vacutainers

1. Allow the red-capped vacutainers to sit upright at room temperature until the blood clots, between 30-60 min.
2. Once a clot has formed, centrifuge the tubes at 3500 rpm for 15 min.
3. Using a thermo pipette (fresh tip), aspirate 500µl serum into each of four 2ml storage vials labelled 'S-0.5' ('S' for serum).
4. Then, aspirate 2ml serum into each of two 2ml storage vials labelled 'S-2'. The second vial may only have ~1.5ml serum.

Grey-capped vacutainer

1. Centrifuge for 15 minutes at 3500 rpm.
2. Using a thermo pipette (fresh tip), aspirate 150µl plasma into a 2ml storage vial labelled 'NaF-P' ('NaF' for sodium fluoride).
3. Invert the remaining contents of the vacutainer to remix.

5. Transportation to NIN lab

1. Place the following storage vials and vacutainers into cool boxes containing gel ice packs for transport at 0-5°C: 'S-0.5', 'S-2', 'EDTA-CBC', 'EDTA-RNAL-1', 'EDTA-RNAL-2, 'EDTA-P', 'NaF-P', purple-capped vacutainer and grey-capped vacutainer (should be last as aiming to keep these at 2-8°C during transport).
2. Vials should be kept in racks (which will be shuttled back and forth from field site each day for sample transportation) within the cool boxes. Vacutainers for each participant should be tied together with an elastic band.

6. Upon arrival at NIN lab

1. Upon arrival at the NIN lab, the 'EDTA-CBC' vial should be used for CBC estimation and the 'NaF-P' vial for glucose estimation **without much delay. For CBC, analysis should be done within 6 hours of collection. Time interval must be monitored and reported to the field manager on a daily basis to ensure integrity of analyses.** Vials containing these samples (and any leftover sample) can be disposed of after estimation.
2. Transfer the other vials and vacutainers ('S-0.5', 'S-2', 'EDTA-RNAL-1', 'EDTA-RNAL-2', 'EDTA-P', purple-capped vacutainer, grey-capped vacutainer) to -80.0°C deep freezer immediately, arranged in racks as per the sample arrangement plan.
3. All bio waste material - vacutainers, needles, pipette tips, cotton wool etc (all in participant's zip lock bag) - should be sent to incinerator.
4. ***While conducting the processing and after sample analysis (for CBC and glucose), ensure to complete the sample processing questionnaire (includes questions on clot formation, aliquots taken and storage location, and results of the CBC and glucose tests). ***

7. Urine collection and processing

1. Ask participants to give you their collected urine sample. Confirm that the sample belongs to the stated participant (as per the label) and probe to ensure against any risk of tube mix-up.
2. Check that required quantity is collected (up to 30ml, minimum 5ml).
3. If participant has not collected the sample, ask them to go and collect it now if possible (after ensuring they have the correctly labelled container).
4. Place the urine sample in cool box straight away (should remain at 0-4°C until processing step back at NIN).
5. At NIN, aliquot 5ml of the urine sample into a glass centrifuge tube (12x75mm) and centrifuge mildly at 2000g for 10 minutes at 4°C (NB check for conversion based on size of NIN centrifuge: conversion here).
6. Discard the pellet and using a thermo pipette with fresh tip, aliquot 2 x 2ml aliquots into 2ml storage vials.
7. Store the aliquots at -80°C immediately according to the sample arrange plan.
8. Dispose of any remaining urine sample, collection containers and pipette tips as bio waste.

8. Sample storage

General principles

- Properly labelled vacutainers and storage vials should reach NIN, Hyderabad at the end of each day of sample collection and should be stored at -80°C in the deep freezer. They should be arranged as per the pre-specified sample storage plan. For each participant, different types of vial will be separated (as generally single type will be needed at once). Duplicate vials should be stored across multiple freezers where possible. Vials will be clustered by household and village.
- Tablet data collected each day should be download via ODK server.
- Field manager will be responsible for overviewing and supervising all these daily activities from at least monthly. The biochemistry lead will be responsible for reporting the total number of samples collected on each day to the field manager and confirm the completion of the daily activities mentioned above (including time between collection and analysis/deep freeze, and any issues that arose).

Summary of samples stored in deep freezers per participants (all vials 2ml capacity)

- 6 serum vials (4x 0.5ml, 2x 4ml)
- 4 EDTA plasma vials (4x 0.5ml)
- 1 EDTA "whole blood" vacutainer (containing ~2.7ml)
- 2 EDTA-RNAlater tubes (each containing ~1.8ml)
- 1 Na-F "whole blood" vacutainer (containing ~1.8ml)
- 2 urine vials (2x 2ml)

Sample collection and processing flow chart (next page)

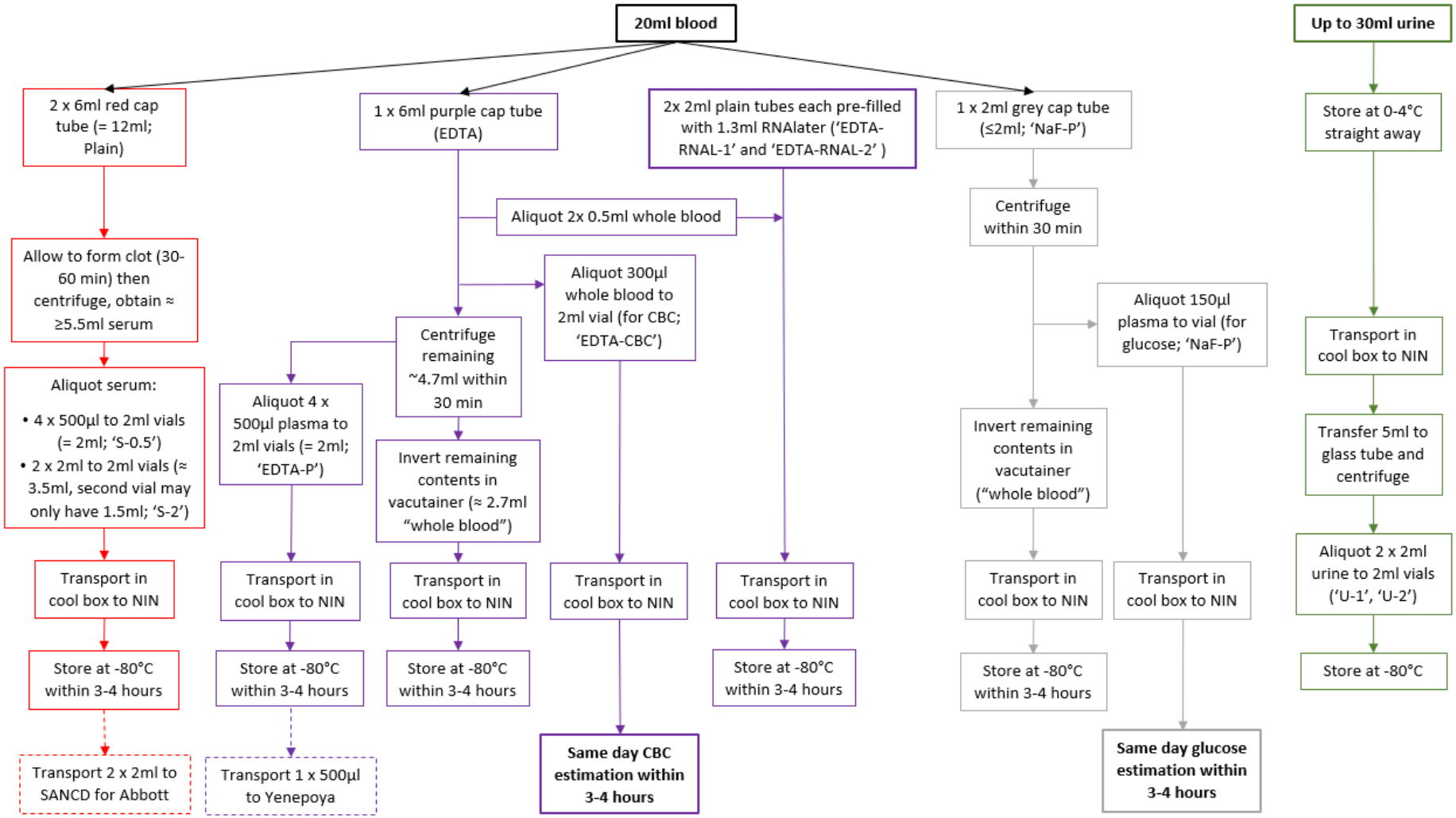


Figure 14: Sample collection and processing flow chart

Equipment list

It is the responsibility of the study manager to (a) ensure at the end of the daily clinic, field workers pack the equipment safely and store it in a safe and secure place and (b) procure additional equipment well in advance of low stock.

Table 7: Daily list of equipment per clinic that should be crosschecked every morning and evening when packing up.

Item	**Use**	**Type and no. needed**
N95 mask	Covid-19: PPE for staff and participants	Minimum 20
Gloves		Minimum 20
Face shield		Minimum 1 per fieldworker
Disposable apron		Minimum 20
Extra masks for participants		Minimum 40
Biohazard bag for waste		
70% Iso Propyl alcohol (IPA)	Covid-19: Disinfection/ Decontamination Solutions	1
7% Lysol Solution		1
Alcohol swabs		1
Sodium hypochlorite 1% solution		1
Hand sanitiser		Minimum 3 (consent, TANITA, grip strength)
Digital IR thermometer	Covid-19: Participant screening	
ADE metallic tapes	Anthropometry	4
Seca Leicester stadiometer		2

Seca 899 portable digital scales		2
TANITA BC418 M57NA		2
Spirit level		1
Lafayette Hand-held Dynamometer 78010	Grip strength	2
Omron HEM-7121	Blood pressure	2
SECA measuring tape		1
Thermometer (Thermo hygro clock J412CTH)		1
Pillow or other support for arm		1
Stopwatch	Physical functioning	1
SECA measuring tape		1
Masking tape		1
Lancet needles	Neuropathy assessment	1
Cotton swabs		1
128Hz tuning fork		1
Tumbling E LogMar Chart (near and distance)	Vision impairments	1
String		1
Noise cancellation headphones	Hearing impairments	1
Vicorder	Vicorder	1
Laptop with vicorder software installed		1
Tablets	Data entry	Minimum 1 per fieldworker
Laptop		2
Microphone	Voice recordings	1
Noise cancellation adaptor		1
Tripods	Video recordings	2
Participant information sheets	Miscellaneous	30
Consent forms		30
Participant check-lists		30
Pens		5

Toilet tissue		2
Batteries		2
Labels		
Ink (for thumb-prints)		2
Air cooler		1

Calibration

Summary

Calibration of equipment will be conducted at daily, weekly, monthly and/or yearly intervals, based on relevant guidelines.

- Vicorder: Yearly (last calibration August 2021 by manufacturer)
- Lafayette Hand-held Dynamometer 78010: Yearly (last calibration August 2021 by manufacturer)
- TANITA: Yearly (last calibration February 2021 by licensed distributor) and weekly (by measuring same field staff (both instruments) and confirming zero readings)
- Headphones: Weekly (using Hearing Test app biological calibration method)
- Seca Leicester stadiometer: Weekly (by comparing to 75cm and 150cm on the ADE metallic tape) and daily (by measuring same field staff and confirming zero reading)
- Seca 899 portable digital scales: Weekly (by comparing against standard weights (5/10/15kg) and daily (by measuring same field staff and confirming zero reading)

Daily calibration of BP monitors, stadiometer, and scales

1. Calibration should be conducted early morning on arrival at the clinics before the subjects come and entered into the calibration sheet on the tablets.
2. As far as possible, readings for the calibration to be taken on the same 2 fieldworkers everyday (on active instruments only, i.e., the one being used in the field on the day). Follow the relevant SOPs for each piece of equipment. Also confirm that the relevant instruments read zero when not in use during daily calibration.
3. Enter the results into a spreadsheet and share the document before the weekly internal APCAPS meetings, where they will be reviewed. If there is a very wide variation in the readings, this will be reported to the study PIs to decide on procurement.

Weekly calibration of headphones

1. The app and headphones should be calibrated on a weekly basis by a fieldworker with normal hearing (either aged 18-35 and no self-report of hearing impairments or following testing and confirmation by an audiologist). The weekly recalibration is required to adjust for changes in efficacy of the headphones.
2. If multiple tablets/ headphones are being used for the hearing test, the same fieldworker should calibrate both at the same time.
3. In a quiet location (i.e., in the office and not in the field), attach the headphones to the tablet, open the app and select "Hearing threshold test" and then "other headphones" and follow the instructions for calibration (~7 minutes total).
4. Then complete the hearing threshold test.
5. Note down the time and date of the test and share with the fieldworkers conducting the hearing test in the field. The calibration coefficients of this test will be used for all subsequent tests that week.

Weekly calibration of stadiometer

1. Extend the metallic tape to 75 and 150cm respectively and measure against the stadiometer. Read the display and enter the result into the calibration spreadsheet.

Weekly calibration of seca scales

1. Add the 5, 10, and 15kg standard weight to the seca scale. Read the display and enter the results into the calibration spreadsheet.

Weekly calibration of TANITA scales

1. On the same fieldworker, complete the TANITA measure (using the relevant SOP) using both TANITA instruments. Add the date, fieldworker name, and "calibration" to the report and take photos of both reports.
2. Save each report photo in a folder with the calibration logsheet and share with the APCAPS internal executive on a weekly basis.

Weekly calibration of BP monitor

1. On the same fieldworker, measure blood pressure (one reading) using the blood pressure monitor (using the relevant SOP). Then measure blood pressure using the sphygmomanometer and enter both results into the calibration spreadsheet.

Medical referral protocol

Summary:

In the field, the medical officer will oversee the procedures and provide first aid/ refer the subject to the local medical college hospital when they deem it is necessary (particularly if participant is complaining of chest pains on exertion, breathlessness, severe pain, or other potentially severe symptoms or conditions).

All respondents will receive a basic medical report even if their results are within normal ranges (see below) (appendix 5). While we have an ethical responsibility to report abnormal results to participants, we do not want to overburden them, particularly if (a) they are unable to have a confirmatory clinical diagnosis and treatment, (b) the tool used is not of clinical standard, or (c) the results are not clinically important. As such, not all results will be reported back to participants (see below tables). The report will be provided ~2-3 weeks following sample collection and the participants will be referred for confirmatory diagnoses. Results that are available immediately will be reported to participants directly during the clinic, these results (if abnormal) will also be provided on the referral report. The sites for referral have been recommended by local medical officers prior to data collection.

For arrhythmia, cardiac abnormalities, or liver fibrosis, the report will be provided by the technician on the day of the clinic/the following day, with an explanation of the results and suggested site for further testing.

Steps (post-clinic):

1. The study manager will collate results and complete the report forms once the data has been checked, which will occur in the week following the clinic.
2. Basic results (height, weight, BMI, blood pressure, fasting glucose and haemoglobin) will be returned to all participants, regardless of whether normal/abnormal.
3. If no additional results are abnormal (see table below), the medical officer will enter "none abnormal" in the further results section of the report form.
4. If additional results are abnormal (see table below), the medical officer will complete the further results section with the relevant results and referral site.
5. The medical officer will return the reports to the participants, explain abnormal results and refer the participant for confirmatory diagnosis and treatment. If participants receive several abnormal results and are concerned, the medical officer should explain that these results may have occurred by chance and repeated tests are needed for a valid diagnosis.

6. If the participant had no abnormal results, the report form does not need to be explained directly to them by the medical officer.

*Table 8: List of measures **that will be reported** to participants*

Measure	**Results reported**	**Classification of abnormal**	**Site of referral**	**Type of report**
Blood pressure	Any	Hypertension: Mean SBP 140+ and/or mean DBP 90+	PHC/104 van	Main report form
Fasting glucose	Any	47 mmol/mol+	PHC/104 van	Main report form
Haemoglobin	Any	<120g/l for non-pregnant women <110 for pregnant women <130 for men	PHC	Main report form
Height, weight, BMI	Any	Underweight: < 18.5 kg/m2 Overweight: 24.9kg/m2 and <30.0kg/m2 Obese: >29.9kg/m2	None	Main report form
Cardiac abnormalities	Abnormal	Abnormal cardiac abnormalities such as systolic dysfunction and valvular heart disease on echocardiography as defined at the discretion of the cardiac technician	Vanasthalipuram Area Hospital	ECHO report

Arrhythmia	Abnormal	Abnormal ECG warranting further investigation as defined by cardiac technician		ECHO report
Liver fibrosis	Abnormal	Abnormal liver scan as defined by cardiac technician	Vanasthalipuram Area Hospital	ECHO report
Neuropathy	Abnormal	mTCNS score 4+	Vanasthalipuram Area Hospital	Clinic and main report form
Peripheral arterial disease	Abnormal	TBI ≤0.7	Vanasthalipuram Area Hospital	Clinic and main report form
Alcohol abuse disorder	Abnormal	AUDIT score – 20+ OR 8+ and high score on AUDIT Q7-10	PHC and free government helpline for alcohol dependency	Clinic
Suicidal ideation	Abnormal	Experienced "Thoughts that you would be better off dead, or of hurting yourself in some way?" at least several days in past 2 weeks (PHQ-9)	Free helpline number for Roshni Counselling Center[6], Telangana	Clinic
Moderate vision impairment	Abnormal	Presenting distance visual acuity worse than 6/18 (<0.3)	Vanasthalipuram Area Hospital	Clinic and main

[6] https://roshnitrusthyd.org/?fbclid=IwAR36_HFba0t1vKdSY1hW93C8668VwuGMAg9grC0jD7E8K_trLgPdl-oi47A

		Presenting near visual acuity worse than M.08 (<0.50)		report form
Moderate hearing loss	Abnormal	Average hearing threshold in better ear ≥ 41 dB HL (Hearing Test app)	Vanasthalipuram Area Hospital	Clinic and main report form
PHC – primary health centre, CHC – community health centre, AUDIT – Alcohol Use Disorders Identification Test, PHQ-9 – Patient Health Questionnaire – 9,				

Table 9: List of measures that will not be reported to participants

Measure	**Method**	**Reason for non-report**
Depression	PHQ-9 (symptom-based screening tool)	Not clinically valid tool
Anxiety	GAD-7 (symptom-based screening tool)	Not clinically valid tool
Asthma	GA^2LEN (symptom-based screening tool)	Not clinically valid tool
COPD	I-PAQ (symptom-based screening tool)	Not clinically valid tools
Pulse wave analysis, augmentation index	UScom BP+ monitor, vicorder	Not clinically significant
Carotid intima media thickness	2D-echocardiography	Not clinically significant
Arthritis	WHO SAGE Symptom based screening tool	Not clinically valid tool
Cataracts	WHO SAGE Symptom based screening tool	Not clinically valid tool
Functioning	Washington short set functioning questionnaire	Referred for sensory impairments (vision and hearing loss)
Gastro-oesophageal reflux disease	Symptom based screening tool	Not clinically significant
Sarcopenia	Slow gait speed and hand grip strength <16 kg, <26 for men and low skeletal muscle mass (TANITA)	Not clinically valid tool (TANITA for muscle mass)
Liver function tests	Fasting bloods	
Lipids	Fasting bloods	

Serum creatinine	Fasting bloods	Blood assays conducted 6-months – 1 year following clinic
Urine creatinine	First pass urine	Urine assays conducted 6-months – 1 year following clinic

First aid

The medical officer will provide first aid as needed or refer the subject. The cases that will most likely require first aid include:

Heat exhaustion:

If you suspect heat exhaustion, get the person out of the sun into a shady location. Lay the person down and elevate the feet slightly. Loosen or remove person's clothing. Cool the person by spraying him or her with cool water and fanning and have the person drink cool water. Monitor the person carefully. If person shows symptoms and signs of a heatstroke like temperature greater than 104 F, fainting, confusion or seizures, the person should be immediately referred.

Fainting

If a subject looks or feels faint during a procedure, it should be discontinued. The subject should be asked to place their head between their knees. They should subsequently be asked to lie down. If they are happy for the test to be continued after a suitable length of time, it should be done so with the subject supine and the circumstances should be recorded. They may wish to discontinue the procedure at this point, but willing to give the blood sample at a later time.

Needle stick injuries

The wound should be encouraged to bleed. The wound should be washed with soap and warm water, if available. Other hand cleaner may be used if water is not available.

Bruises

For any bruises following the blood sampling, elevate the injured area and apply ice or cold pack for 30 to 60 minutes at a time for a day or two after the injury.

Data storage and transfers

Summary

A range of data types will be generated in the field during data collection. The following sections describe the methods used to securely store the data in the short- (in the field and in the week following data collection to perform data checks) and medium-term (across the period of the grant).

Equipment

- Password protected laptops.
- Password protected tablets.
- Password protected desktop PC (at NIN, access to study manager)
- Portable hard drives (for data transfers from field)
- APCAPS 5tb hard drive installed on NIN server
- APCAPS sinology server

Data sources

- Tracking and recruitment log (appendix 2)
    - Format: Excel spreadsheet, all potentially eligible participants listed
    - Location: Password protected laptop
    - Data linkage: participant ID and village number
- Consent forms
    - Format: Paper based, 1 per participant
    - Location: Designated folder with team leader
    - Data linkage: ID and name
- ODK data (questionnaires, anthropometry results (including photo of TANITA output), TBI results, timed-walk time, photos of face/mouth/house, video of timed walk/body, neuropathy, vision and hearing examination results
    - Format: 1 ODK dataset per participant per station
    - Location: ODK Collect (password protected tablets)
    - Data linkage: ID saved to questionnaire by scanning QR code (contains participant, household, and family ID), separate text box for entering participant ID in case of issues with QR code
- Audiograms
    - Format: jpeg, 1 per participant

    - Location: Hearing Test app (tablets)
    - Data linkage: Participant ID saved to audiogram image
- Accelerometer data
    - Format: Actigraph .agd file, 1 per participant (6-m timed walk) and 1 for every 1/3 participants (48-hour measures)
    - Location: Designated folder on laptop
    - Data linkage: Participant ID and initials entered into accelerometer during setup
- MiBand data
    - Format: Zip file containing multiple .csv files
    - Location: Unzipped contents are stored in a Google Drive folder
    - Data linkage: Participant ID is saved in participant sub-folder name
- Vicorder data
    - Format: csv file with all observations appended automatically via Vicorder software
    - Location: Designated folder on laptop
    - Data linkage: Participant ID and initials entered into vicorder during setup
- Voice/breath recordings (3/4 per participant):
    - Format: m4a audio files
    - Location: Designated folder on password-protected laptop
    - Data linkage: Audio-recordings saved into separate participant sub-folder in audio recording folder on laptop, sub-folder saved with participant ID and initials
- ECG images and outputs (csv), ECHO, CIMT, liver span DICOMs:
    - Format:
        - ECG output – csv, appended.
        - ECG report - PDF
        - ECHO, CIMT, liver span - dicoms, 1 folder per participant
    - Location: ECHO team laptop, transferred to designated hard-drive and shared with field team on day following main clinic
    - Data linkage: All filenames saved with participant ID and initials
- Uscom BP+ data
    - Format: 1 xml file per measure, 3 per participant
    - Location: BP+ monitor's SD card
    - Data linkage: test number for each BP measure recorded in ODK BP questionnaire, used to link participant ID to each observation (see: Data transfer of UScom BP+ data)

- Infrared foot images
    - Format: 1 PDF file or 2 JPEG images
    - Location: CAT 361 phone camera
    - Data linkage: All filenames saved with participant ID
- Retinal images
    - Format: 6 JPEG images per participant
    - Location: Camera's SD card
    - Data linkage: test number of each photo noted manually with participant ID by fieldworker, images saved in separate sub-folder (saved with participant ID) for each participant when transferred from the camera to designated folder on laptop

Short-term data storage

Daily, at NIN after clinic:

1. Push every questionnaire from ODK Collect to ODK Central
2. Send each audiogram from Hearing test app to study Gmail account and download to weekly folder on study manager's password protected NIN desktop PC
    a. Rename each file with participant ID
3. Vicorder dataset, audio-recordings, accelerometer datasets
    a. Transfer to daily designated data transfer hard drive from laptops
    b. Transfer from hard drive to designated folder on NIN desktop PC
4. Transfer ECHO data from designated hard drive to designated folder on NIN desktop PC
5. UScom BP+
    a. See below
6. Once transferred, manually compare the number of files for each data source to the sample tracking sheet to confirm no data has been lost in the transfers.
7. Troubleshoot if file counts or ID numbers do not match the tracking sheet (i.e., compare to existing files to identify correct files/IDs)

Data transfer of UScom BP+ data

Equipment

- Laptop
- SD card reader

Steps

1. Open the BP+ Reporter programme on the laptop.

2. Select ‘add a new person’ in the menu at the top of the screen. Enter the participant’s initials into the first and family name boxes, and enter the APCAPS ID into the person ID box.
3. Repeat this for all those participating that day.
4. Plug the SD card reader into the laptop.
5. Press the import button in the menu at the top of the screen 
6. A dialog box will open, select the SD card folder, select all the xml files for that day’s data collection, and press OK.
7. The files will be listed on the left-hand menu and highlighted in red. The name will state “Needs Saving”.
8. Each xml file corresponds to one test. Every participant should have three readings and therefore three files. Each xml file will be named with the test number which was entered into the ODK questionnaire.
9. Open the anthropometry questionnaire for the participant and scroll to the blood pressure section. Identify the three test numbers entered for that participant.
10. Select the xml file with the correct test number and press save.
11. A dialog box will open, select the ‘Existing people’ tab and search/scroll to the current participant. Press save.
12. Repeat steps 10-11 for all participants and repeat measurements.
13. Select export  . Select “all” in the right-hand corner and **tick the “include waveforms” option at the bottom left-hand corner. This is very important, please do not forget this step.**
14. Select “Export CSV” and select the designated folder for saving the csv file. This will combine data for each of the participants and repeats.
15. Save the file as “uscom_date(s)ofdatacollection”
16. Transfer the file to the NIN desktop PC for appending to other datasets.

Medium-term storage (across grant period)

Every Friday, at NIN

1. ODK data
    a. Run STATA script to append datasets and check data duplicates
    b. Compare observations in appended files with expected numbers from sample tracking to confirm no data has been lost.

c. Transfer media files to relevant folders on NIN server
d. Copy final stored documents to:
    i. APCAPS sinology server
    ii. Designated external hard-drive

2. ECHO, ECGs
    a. Transfer weekly Echo folder from NIN desktop to designated folder on NIN server
    b. Transfer weekly ECG data from NIN desktop to sinology server
        i. Transfer weekly DICOMs from NIN desktop to cloud server storage.
    c. Transfer weekly Echo folder from NIN desktop to designated external hard drive
3. Other data-sources
    a. Transfer weekly audiogram, accelerometer, audio-recordings, and vicorder folders from NIN desktop to NIN server
    b. Transfer weekly audiogram, accelerometer, audio-recordings, and vicorder folders from NIN desktop to sinology server and designated external hard-drive
    c. Compare observations in appended files with expected numbers from sample tracking to confirm no data has been lost, and delete week's files from NIN desktop.

Data quality checks

Summary

Weekly quality control checks will be performed by the study team. As the questionnaire data will be collected on a tablet and make use of the ODK platform, this allows us to restrict certain implausible values (e.g. such as age below 18 or above 120 years) and make certain questions mandatory at the time of data entry. This is likely to reduce the overall number of errors in the data entry process as the interview occurs. However, we may will monitor the values in certain unrestricted variables (e.g. the number of servings of each FFQ item consumed at a time on average) and check for other potential data quality issues that cannot be easily prevented in programming the questionnaire. Once new entries have been uploaded to the ODK platform, data quality reports will be assembled on a weekly basis for review by the study team. These reports will include visualizations of the continuous variables which contain no restrictions on unfeasible variables. The reports will also display the percentage of entries which have missing data for each variable, identify cases of straight-lining among groups of variables where it would be unreasonable to have consistent answers within an individual (e.g. answering "no" to every single FFQ item), surveys which have been completed in an unreasonably short amount of time, and the frequency of contradictory or unreasonable answers in the questionnaire (e.g. parent age is reported to be younger than the

respondent age, conflicting answers about occupation in basic demographics and physical activity questionnaire section). Further checks will ensure that digital data, such as images, videos, and audio recordings, have been stored in the database with the correct file format and can be properly linked to a study participant. These reports will be assessed during weekly study meetings. During regular meetings, interviewers can also review any items of the questionnaire which are unclear to either themselves or to participants for potential revision with the study manager.

Other data sources include: photos, walk and body shape videos, accelerometer data (48 hour and 6-m timed walk), vicorder data, ECG measures and images, liver and cardiac ECHO and CIMT DICOMS, audio-recordings, audiograms, UScom BP+ wave form data, infrared images of feet, and retinal photos.

On a weekly basis, a random 5% sub-sample of all non-identifiable data will be shared with co-investigators for quality control checks while a random 5% sub-sample of identifiable data (e.g., facial images, videos) will be checked by the study manager at NIN to ensure protocols are being followed. The team will confirm that measurements appear to have been recorded appropriately, and that audio and video files are of an appropriate length given the content type. Further, coordinate data, as in the USCOM BP+, will be plotted to ensure that the data is usable for analysis. Overnight accelerometer data will be checked against MiBand data to ensure that both sources of data cover the same dates and approximately the same times. If potential issues are identified during quality control checks, retraining will be conducted with fieldworkers and/or equipment will be checked and recalibrated if required.

Weekly, at NIN

ODK

1. Every Friday, download the weekly ODK dataset from ODK Central onto the NIN Desktop PC.
2. Run coding script to append ODK questionnaire datasets from all prior weeks.
3. Run data checks script to identify data duplicates and missing data.
4. Troubleshoot data duplicates and missing data, for instance assess tracking document for reasons for missing data, confirm potential issues with fieldworkers, and triangulate between questionnaires to assess any issues with entry of IDs. In extreme cases, for instance if the data has been entered incorrectly and is key, repeat the questions/measure with participant.
5. Enter the detail of each data issue into the “edits logsheet”, including decision made (e.g., whether to edit in the dataset) and rationale for decision.

6. For data issues that can confidently be explained, edit the script to fix issues. Clearly note the reasons for the edits in the script, date and sign the relevant code. **Please note, edits should not be made to the data within ODK Central.**
7. If any questions/measures are repeated with participants due to data issues, use the same script to amend the appended dataset.
8. Rerun the script to generate the appended and edited dataset.
9. Finally, run quality control script on the appended dataset to generate (a) weekly recruitment and completion report for sharing with coinvestigators, and (b) weekly data quality report for sharing with APCAPS internal executive at weekly meeting.

Other data-sources

1. Study manager to upload random 5% de-identified sample of all other data sources to APCAPS SharePoint for weekly assessment by APCAPS internal executive team
    a. Study manager to share random 5% of liver scans with liver expert
2. Remove from SharePoint following the weekly meeting.

Repeatability protocol

Summary

We will repeat the protocol with a random 5% of participants of the main protocol within 2-4 weeks of initial data collection. The repeat estimates will be used to correct for measurement error during analysis and to monitor data quality. A sub-sample of N=250 will offer high-moderate precision for variables with correction factors of 1.6 (approximately expected for blood pressure, grip strength), moderate precision for variables with correction factors of 2.0, and high precision for variables with correction factors of 1.0.

Protocol

1. The participant will be informed of the repeatability sub-study as they depart the clinic following initial data collection and permission to be invited for the repeatability study will be requested.
2. As clinics in the village are coming to an end, the study manager/another field staff will prepare the list of participants eligible to be invited for the repeatability sub-study (i.e., those that participated at initial data collection and who gave permission to undertake the repeatability study). A random sample of these (selected through a random number generator) will be invited to the clinic alongside the final participants in the village. Recruitment of the repeatability sub-study participants should continue until 5% of the village participants have been re-recruited.

3. The repeatability protocol will cover the following measures: anthropometry (weight, height, body composition, circumferences, grip strength), TBI, blood pressure and Pulse Wave Analysis, physical functioning, neuropathy assessment, vision and hearing impairments, ECHO/ECG/CIMT, liver spans, wearable devices (accelerometer and mi-band wearable watch) and a sub-section of the questionnaire (diet and physical activity).
4. The repeated measures will be conducted by the same fieldworker. The repeat data will be compared to the original data as data collection is ongoing as part of data quality checks by the study manager. Discrepancies will be identified and retraining will be conducted based on the findings.
5. In the first 2 villages, the complete questionnaire will be conducted by a different fieldworker t to assess inter-rater reliability and data quality. Discrepancies will be identified and retraining on the questionnaire will be conducted based on the findings. It is assumed that by the third village the majority of data collection issues have been identified and acted upon, though the wider (full questionnaire) repeatability study could continue. The decision will be made on the quality of the prior village data.
6. As described previously, the 5% repeat sample will also be used to collect additional measures which are time-consuming to complete during primary data collection (a) video of body shape, and (b) photo of mouth using cheek retractors.
7. Agreement between continuous variables will be assessed by computing the intraclass correlation coefficient (ICC), using a two-way mixed effects model for absolute agreement to determine the relationship of test-retest values by the same fieldworker. Agreement for categorical measures will be determined through a binary system, simply scoring whether responses match or do not match.

Appendix 1: Tracking log

Village	
HHID	
previous hhID	
ID	
ha1id	
subject_id	
rank	
type	
Sex	
Age	
DOB	
Status 2012	
Known status	
FU4 tracking Status (1=alive, 2= deceased, 3=migrated,4 = married and moved, 5=pending, 6=not traced, 7=repeat)	
Contact number	
Code of migration (1= within APCAPS village, 2=within local area, 3= within state, 4= outside of state)	
if migrated to APCAPS village, village code (derived)	
Current status	
Year of migration	
Place of migration & Address	
Date of death	
Permission to follow-up (Y/N)	
Contact number of respondent	
Address of respondent	
Place of death	
Medical COD	
Proposed COD	
Known conditions of illness	
Whether death registered?	
If yes, do you have death certificate?	
Comments	

Appendix 2: Recruitment/data collection log

Village number	Ha1id	Subject_id	Sex	Current age	Date of birth	Current status*	Participated? ^	Complete? ^	Details of pending modules	Reason for pending modules	Reason for not participating	Comments

* Deceased / Migrated / No information / Not interested to participate / Residing within same village / Residing in other APCAPS village / Residing in local area

^ Yes / N

Appendix 3: Participant information sheet (clinic) - English

PARTICIPANT INFORMATION SHEET

Andhra Pradesh Children and Parents Study (APCAPS)

Extending an Inter-Generational Cohort to Develop a Multimorbidity Research Platform in Rural and Urbanising India

Purpose of the study

Researchers at the National Institute of Nutrition in Hyderabad, Indian Institute of Public Health - Hyderabad and at the London School of Hygiene and Tropical Medicine are interested in understanding multimorbidity in India. In India, people who have more than one long-term health condition ("multimorbidity") are more likely to have high healthcare costs, which they usually pay out-of-pocket, and to be disabled which can affect their ability to work. As a result, multimorbidity can impact the health and well-being of people and can impact the economic well-being of families. People living in both rural and rapidly urbanising communities are particularly vulnerable to rapid rises in multimorbidity because social changes are affecting behaviours (e.g. people are eating more processed foods) and environmental exposures (e.g. rising air pollution from traffic), while old, poverty-related health issues (e.g. malnutrition) remain common.

You have been chosen for this study as you participated in an earlier study conducted by National Institute of Nutrition. This study will help researchers to understand what causes multimorbidity, so that we can develop ways to prevent it. This study will help to predict future needs for health services in India which will benefit planning. Finally, the study provides an opportunity for you to gain important information about your health status.

Questions and concerns

You are being invited to participate in this research study. Kindly read this information sheet attentively. If you are not clear about anything or there is any uncertainty, then you are free to ask any questions when you receive a visit from the study staff. Sign the consent letter only when you understand the nature of this study fully along with your rights as a participant. You are free to discuss it with anybody whose consultation is important to you.

Voluntary participation

It is entirely your decision to participate in the study. If you want to discontinue at any point of time, you are free to leave this study without stating any reason. Your medical care will not be affected by your decision.

What does it mean to participate?

Participation in this study involves answering some questions about your general health including physical and mental health, habits, having body measurements taken, your blood drawn (**20ml)**, providing a urine sample, and a clinical examination, which includes measures of your heart (cardiac ultrasound and ECG), liver (liver ultrasound), blood vessels (vascular ultrasound and peripheral vascular assessment), muscle strength, eyesight,

and hearing (over 45s only). All the examinations will be conducted by trained staff. We will also ask to take voice recordings, a video of you walking a short distance (6-meters), facial photographs and a body (clothed) photograph and video. We may ask some people to wear a special wrist-watch for several days to monitor physical activity. Study staff will be on hand at all times to answer any concerns you may have. If required we may take information from your close relative also (spouse or children or other care givers). Your answers will be confidential and used only for the study.

The main clinical examination will take place in central locations in your village, and the blood sample collection and a brief additional questionnaire will be conducted at your household in the following days. We may ask to take photographs of your house. If you consent to join the study, you will still be free to opt-out of any tests or measures at any time. Your information will be confidential and used only for the study.

You will be required to give a blood and urine sample

You will be asked to fast overnight before the visit in which you give your blood sample. During the visit we will ask you to donate a small sample (20ml) of your blood. Trained staff will draw the blood. The supplies used for drawing blood will be safe and sterile and used only once and the supplies will be destroyed after use. The blood you give will be used for research purposes only. Any blood that is left over after the test may be used for further tests related to medical and genetic (tests to find out whether any diseases run in the family) research. We will ask you to provide a small sample of your urine at the same time. We will provide you with a container to collect the sample yourself.

Referrals

If your responses suggest you have symptoms of tuberculosis, with your permission, we can connect you with your local health services to have confirmatory testing and treatment. We may contact you and/or your local ASHA worker to ask information on your test results at a later date.

Follow up in the future

The present research does not require the research team to see you again. However, important information can only be gained by linking your current health and lifestyle to what happens to you in the future. Therefore, we would like to use your contact information and invite you to continue to participate in the future if you wish.

Benefits from the study

You will get a medical examination by an experienced team, including doctors. In the weeks after the examination, we will provide you with a report with results on your: blood pressure, blood sugar (for diabetes), haemoglobin (for anaemia), body mass index, cardiovascular and liver health, eyesight and hearing (over 45s), and nerve health (people with diabetes). Counselling will be given to you based on the results of the medical examination and blood tests. By participating in this study, you will help researchers gain an understanding of

multimorbidity in rural and rapidly urbanising parts of India. Your participation will also help them understand how lifestyle, physical activity and dietary habits affect your health.

Risks of participating in the study

We do not expect that you will incur any risks by participating in this study. Blood drawing may cause a small amount of discomfort, but it is only temporary.

Financial costs

You will not incur any costs as a result of your participation in this study. Any expenses incurred and loss of daily wages towards time spent for this study will be reimbursed. Refreshments will also be provided.

Confidentiality

If you decide to take part in the study, all details provided by you will be kept confidential and it will only be made available to investigators related to this study. Information will be stored in a password protected computer in Hyderabad. Study staff will protect your personal information closely so no one will be able to connect your responses and any other information that identifies you. The study results will be published in research magazines and reports and de-identified data will be made available to other researchers on the designated APCAPS website (https://apcaps.lshtm.ac.uk/).

Funding & Coordinating agency

The study is being supported by funds from the Medical Research Council (a research charity) and analytical support from Abbott Diagnostics (a healthcare company).

Contact for further information

If you require any further information or need to clarify some issue, you can contact any of our study team members at National Institute of Nutrition, Hyderabad and Indian Institute of Public Health - Hyderabad.

National Institute of Nutrition:

Tel: Project Office: 040 – 27197256; Project Officer: Ms. Santhi Bhogadi: 9177515161.

Indian Institute of Public Health – Hyderabad:

Dr Gowri Iyer, Tel: 04049006016

What your signature means

Your signature on the next page means that you understand the information given to you about the study. If you sign the form it means that you agree to join the study. You will be provided a copy of this participant information sheet to keep with your records.

Appendix 4: Consent form (clinic) - English

CONSENT FORM

Andhra Pradesh Children and Parents Study (APCAPS)

Extending an Inter-Generational Cohort to Develop a Multimorbidity Research Platform in Rural and Urbanising India

Participant: Shri/Smt/Kum (First & Last Name) _____

Address (Lane, Town, State, Pincode)_____

I, _____exercising my free power of choice, hereby give my consent to be included as a subject in the clinical study - Andhra Pradesh Children And Parents Study (APCAPS) "Extending an Inter-Generational Cohort to Develop a Multimorbidity Research Platform in Rural and Urbanising India" (For the examination today, we will ask you to undertake the following: clinical interview, measurement of body size, and a visit with the doctor. We will also ask you to give blood and urine sample. The examination will last until the afternoon.)

Statement	**Initials/Thumb print**
I am free to participate or not to participate in this study.	
The purpose of this study was explained to me in my own language.	
I have been given the opportunity to ask questions and reply was given for all the questions to my satisfaction.	
I have been informed by the investigators about the process including the nature, objective and known likely inconveniences related to this study and I have understood them (information sheet v2).	
My clinical data are strictly confidential and I only authorise the persons, involved in the research, identified by the sponsor or health authorities to consult about the same.	
My contact details and relevant results may be passed onto a health professional for their support in taking confirmatory tests and organising my treatment. I and/or the health professional may be contacted again to provide information on the test results.	

By signing this form, I give my free and informed consent to take part in this study as outlined in the information sheet and this consent form. Specifically, I agree to being interviewed, examined and having **(20 ml)** blood drawn. I agree to my information, including results of blood tests, to be used in research.	
I give permission for any blood that is left over after the tests to be stored and used for further laboratory tests for medical research.	
I understand that the blood sample may be used for genetic research aimed at understanding genetic and epigenetic influences on diseases.	
I understand that for all practical purposes I may not gain anything by participating in the study though in the long run it may be beneficial to the community.	
I understand that I can withdraw from the study at any point without giving any reasons and withdrawing from the study will not affect me in any way, for instance by affecting my medical care.	
I have been given a copy of the information sheet and consent form to keep. By signing this form, I have not given up my legal rights.	

Name of the Participant _____

Signature/Thumb print of the Participant_____

Date_____

For non-literate participants:

Name of witness_____

Signature of witness (in case participant is illiterate) _____

Date_____

Name of the Investigator_____ Signature of the Investigator_____

Date_____

Appendix 5: Medical referral form

Andhra Pradesh Children and Parents Study (APCAPS)

REPORT FORM

Date: _ _ /_ _ /_ _ _ _

Subject ID: **Village name:**

Name:

Age: **Sex:**

1. **Body build**

Measure	Results	Remarks
Height (cm)		
Weight (kg)		
Body Mass Index (BMI)		Underweight: < 18.5 kg/m2 Overweight: 24.9kg/m2 and <30.0kg/m2 Obese: >29.9kg/m2

2. **Physiology**

Measure	Results	Remarks
Blood pressure (mmHg)		Normal: SBP <120 and DBP <80 mmHg High: SBP ≥140 and/or DBP ≥90 mmHg

3. **Biochemistry investigations**

Measure	Results	Remarks
Fasting glucose (mg/dl)		Normal: 70 to 110 mg/dl High: >=126 mg/dl
Haemoglobin (g/dL)		Females: 10-16 g/dL Males: 12-18 g/dL

4. **Further results**

Note: Kindly verify your results with a medical doctor if they are not in the normal range, and take his/her advice before starting any treatment.