

# **ELSA Wave 11 Health Visit -**

**Protocols – Grip Strength,  
Hair Sample & Lung Function**

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# 1 Grip Strength

## Introduction

The grip strength is a test of physical ability. It is used in a number of studies and is thus useful for drawing comparisons between countries and cultures. Hand grip strength is important as it affects every day function, such as raising the body weight and lifting heavy objects, and declines with age.

## Exclusion criteria

Participants are excluded from taking the grip strength measurement if:

- They are pregnant
- They have swelling or inflammation, severe pain or a recent injury to their hands
- They have had surgery on their hands in the last six months

If there is a problem with only one of the participant's hands, just take measurements on the other hand.

## Equipment

You will need:

- A Smedley Dynamometer (Gripometer) (Note: there may be a project specific protocol if a different dynamometer is to be used).
- Antibacterial wipes

## Preparing the participant

Explain to the participant the reasons why the grip strength test is required and what is involved, i.e. gripping for a few seconds only. Explain that it is very important that they try their hardest for the most accurate reading of their grip strength. Where possible have the participant remove any large rings, which may cause pinching when they grip the dynamometer

## *Demonstrating*

- The participant is not to begin the grip strength test until it has been demonstrated.
- If after the demonstration the participant does not understand, the test should be demonstrated again rather than relying on verbal instructions.
- The demonstration should be repeated only once.
- If the participant still does not understand, skip the test and continue the interview.
- Do not coach the respondent

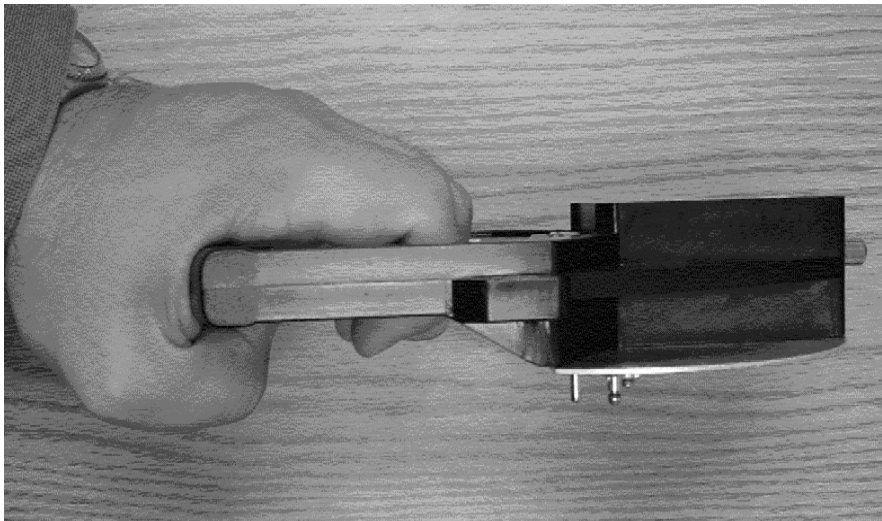
## Procedure

1. Adjust the lever of the dynamometer to suit the participant's hand. To do this:

- a. Put the black bar of the dynamometer on the pads at the top of their palm (see Figure 6), and the middle silver bar at the level of the crease across the middle of the fingers
- b. Check to see if it is a good fit by asking the participant to grip the dynamometer- the middle section of their fingers should be flat across the top of the metal bar (see Figure 7). If they are not, you will need to adjust it.
- c. To adjust it, you need to lift the metal lever on the side of the dynamometer and rotate the grip until it is in a more suitable position. Repeat step b.
- d. When you have a good fit, replace the lever on the side of the dynamometer.



**Figure 8 Aligning the dynamometer with the hand**



**Figure 9 Dynamometer lever on second phalanx in gripping action**

2. If possible get the participant to stand up with their arms by their side.
3. Hand the participant the dynamometer and allow them to have one practice with it in their dominant hand.

4. After they have had one practice, ask them to put it in their non dominant hand with their upper arm against their trunk and their forearm at a right angle to the upper arm. If the participant is finding the dynamometer too heavy to hold, they can use their other hand to support their dynamometer or you can support it if appropriate.
5. Have the dial of the dynamometer face outward.
6. Before commencing the measurement check to make sure that the arrow is resting at zero.
7. Using the instruction “Ready, Steady, Squeeze”, ask the participant to squeeze as hard as they can for two seconds with their non dominant hand.
8. Record the value on the scale to the nearest whole number, **NO** decimal places on the measurement record card. The most accurate reading is achieved if you look directly down on the scale.
9. Repeat steps 7 and 8 three times for each hand, alternating hands each time. You should have six values altogether.
10. Record the results in CAPI.

### **Additional points**

- If a participant is unable to stand to carry out the grip strength test, they can sit in a chair provided they can keep their upper arm against the trunk of their body with their forearm at right angles to their upper arm. If they are finding the dynamometer too heavy to hold they can use their hand to support the dynamometer.
- If a participant is unable to complete the required number of ‘squeezes’ of the dynamometer then record what they have been able to do and code the remaining ‘squeezes’ as measurement not obtained.
- If the participant is only able to carry out the procedure using one arm, make a note of this in CAPI and continue to conduct the procedure as above using only one arm. The results for the arm that cannot be used should be coded as measurement not obtained.
- Between participants and before packing away, wipe the handle of the dynamometer with an antibacterial wipe to reduce potential cross infection.

## 2 Hair Sample

### Introduction

Hair Sample analysis can be used to measure the stress hormone called Cortisol, which is stored in the hair. The amount of cortisol released over time can therefore be measured in a sample of hair taken from close to the scalp in the posterior vertex area of the scalp. This area of hair growth on the scalp shows the most consistent levels of Cortisol, compared to other areas of the scalp's hair growth.

Prior to gathering this sample, written informed consent must be obtained, as per the project instructions. The CAPI programme will also have asked you to note down any medications or treatments of any kind that might impact on Cortisol levels in the respondent.

### Equipment

For each respondent hair sample the following equipment is needed:

- 1 x Pair of well fitting disposable vinyl gloves
- 1 x Pair 5 inch safety scissors with 'ruler' blades
- 1 x Milton antibacterial hand gel
- 1 x Pack of Milton antibacterial wipes
- Disposable respondent sample pack containing the following (the plastic bag can be used as the rubbish bag for the contents to be discarded into the respondent's household waste):
  - 1 x 5 inch comb
  - 2 x hair sectioning grips
  - 2 x wire food bag ties
  - 1 x hair tie
  - 1 x foil
- 1 x Pre-printed Respondent Sample label (from barcode sheet)
- 1 x Sample dispatch note (in consent booklet)
- 1 x Hard backed A5 dispatch envelope addressed to Brentwood office





### Exclusions




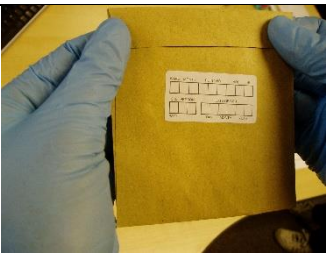

ELSA respondents are excluded from the hair sample in the following circumstances:

- Pregnancy (in 'younger partner' respondents)
- Breastfeeding (in 'younger partner' respondents)
- Current scalp condition rendering the hair sample soiled or at risk of transmission of an unknown / known blood borne virus (e.g. active bleeding or infection)

- Respondent is unable to sit with head remaining still (e.g. continual tremor, head shaking)
- Has less than 2cms of hair length in the posterior vertex scalp area (not including any hair extensions)
- Does not wish to give written consent.

**Procedure**

<p>1. Following explanation of the procedure (as per CAPI project instructions) and gaining of written consent, ensure the respondent is sitting in a suitable chair, where the biomedical fieldworker can access the posterior vertex area of the respondent's head and have the equipment close to hand.</p>	
<p>2. Open a respondent hair sample pack and lay out the contents. The bag can be used as the rubbish / discard bag.</p>	
<p>3. Use the Milton hand gel cleanse your hands and put on a pair of well-fitting vinyl disposable gloves.</p>	
<p>4. Ask the respondent to tip their chin down towards their chest so that the posterior vertex of the head rotates upwards. Inform the respondent of the area the sample will be taken from. The posterior vertex is the back part of the crown of the head as highlighted in the picture.</p>	
<p>5. Gently comb the respondent's hair over the posterior vertex area to align the hair strands together.</p>	
<p>6. Using the hair sectioning grips, gently secure the hair off on each side of the identified sample site, ensuring the hair strands left in the middle constitute the width of around 2.5mm (1/4 cm – or half of the width of a standard pencil)</p>	

<p>7. Comb the remaining hair again to align the strands for the sample and gently twist along its length to assess the thickness of the hair to be sampled.</p>	
<p>8. Firmly secure the hair sample with either a wire tie or a hair band approximately ½ cm (5mm) from the scalp and keep hold of the hair at the wire tie position.</p>	
<p>9. Cut the hair sample as close as possible to the scalp (between the scalp and wire tie). The scissors should be positioned with the blades pointing towards the floor, taking care not to nip the respondent's scalp.</p>	
<p>10. Once the hair sample has been cut tighten the wire tie to ensure the hair strands do not become free.</p>	
<p>11. Place the foil shiny side down on a flat surface and place the sample on the foil. Stick a red arrow by the end of the hair sample which was closest to the scalp. Wrap carefully and place the barcode label on the front of the package. If the hair is wet or damp, allow to dry for a few minutes.</p>	
<p>12. Place a pre-prepared respondent sample label on the foil and place the packaged sample in the hard-backed A5 envelope and send back to the office.</p>	
<p>13. Using a Milton antibacterial wipe – cleanse the scissor blades and leave to dry before using again or packing away.</p>	
<p>14. Place all disposable items into rubbish bag, remove gloves, cleanse hands with Milton antibacterial hand gel and ask respondent to dispose of the rubbish bag in</p>	



their normal household waste (the respondent may wish to recycle the comb and hair sectioning grips).

15. Complete the CAPI and dispatch note as per project instructions.

16. Place labelled hair sample envelope into the hard backed A5 dispatch envelope with the dispatch note and post in a post box with same day delivery. **Note:** If there is no same day postal service then the sample should be kept at room temperature and posted in the next available service.

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## 3 Lung function

### Introduction

Lung function tests assess respiratory function and are an indicator of general health as they tell us a lot about the respiratory health of the population.

A wide range of variables can affect these factors, for example smoking, chronic bronchitis, poorly controlled asthma, some muscular disorders and many other conditions. Results also vary according to a respondent's age, sex, height and ethnicity.

Lung function measures are affected by the way the participant performs the task, and the adequacy of their technique. In turn, this is affected by the way the biomedical fieldworker is able to explain the task, demonstrate the technique, and how well they motivate the participant to perform the task. It is therefore important that you give clear and concise instructions and observe the participant whilst they are performing this test.

Participants do find this test tiring and do put a lot of effort into this test. Therefore, always observe and assess the participants when they are doing this test, allowing adequate time in between to rest and get their breath back.

The main things we are measuring are:

- Forced expiratory volume in 1 second (**FEV1**) – the volume in litres that can be expelled in the first second of a forced expiration.
- Forced Vital Capacity (**FVC**) – the full volume of gas in litres that can be expelled.
- Peak Expiratory Flow (**PEF**) – the fastest rate of exhalation recorded during the measurement in litres per minute.
- Forced Expiratory Ratio (**FER**) - this is FEV1 expressed as a % of FVC.

### Exclusions

Respondents are excluded from the lung function measurement if they:

- Have had any of the following surgery in the last three months: abdominal or chest surgery, brain surgery or vascular surgery;
- Have detached retina or eye surgery or ear surgery in the past three months;
- Have had a middle-ear infection in the past 4 weeks;
- Have had a heart attack in the last three months;
- Have been admitted to hospital with a heart complaint in the past month;
- Have had pneumothorax (a collapsed lung) in the last three months;
- A resting pulse rate more than 120 beats/minute (Taken from BP module and automatically excluded from module. If no BP measure, we'll include as this is a rare scenario);

- Are currently taking medications for the treatment of tuberculosis;
- Are pregnant (rare on ELSA).

The CAPI will assess the above and exclude respondents as necessary. The resting pulse rate will be taken from the blood pressure module recorded at the start of the interview. If not blood pressure reading is taken, the module will be skipped.

As with all measurements and samples, a respondent is excluded from the lung function measurement if the biomedical fieldworker deems it unsafe for them to continue. This may be due to concerns over the respondent's understanding of the measurement or concern over infection control if they have a cough or chest infection.

## **Equipment**

- Laptop with NDD Easy on-PC software
- NDD Easy on-PC spirometer
- Disposable filter
- Disposable spirette (mouthpiece)
- Disposable nose clip
- Chair (if possible, chair with arm rests)
- Water for participants

## **The NDD EasyOn PC spirometer**

The NDD EasyOn-PC spirometer plugs directly into the laptop. This allows for the respondent's results to be obtained automatically by the spirometry program which has been installed on the laptop. Therefore, the respondent's results do not need to be manually entered into the CAPI. Additionally, the spirometry program will give you the overall session quality as a grade and tell you when a respondent has done sufficient manoeuvres for the overall test to be acceptable. If a respondent is struggling with the lung function manoeuvre, the spirometry program will give you the instructions you need to tell the respondent to help them give successful and valid blows.

## **Caring for the spirometer**

The spirometer needs minimal care and maintenance. There are no moving parts which need to be cleaned at regular intervals. Please do not attempt to take the housing apart to clean it, this is not necessary and will result in the spirometer being damaged. Proper use of the spirette with the spirometer will ensure the interior of the spirometer remains clean.

It is important that the external housing is wiped over before it is used by a respondent. This will remove any dust and fingerprints from the plastic casing. This should be done using an anti-bacterial wipe. The inner tube of the spirometer which contains the sensor does not need to be cleaned as the spirette ensures that this remains uncontaminated. Tests done by the manufacturer show that the spirette prevents 99.9% of germs from being in contact with the inner tube of the spirometer. It is important that you wipe the external plastic casing between respondents within a household.

At no time should the spirometer or the attached cord be immersed in water. If this happens, please report it to the operations team who will need to return the spirometer to the manufacturer to be checked.

Please store the spirometer in the plastic zip lock pouch that is provided. This will ensure it remains free of any dust and dirt and will help to keep it protected. This bag should be washed in a warm soapy solution, rinsed and left to air dry as necessary.

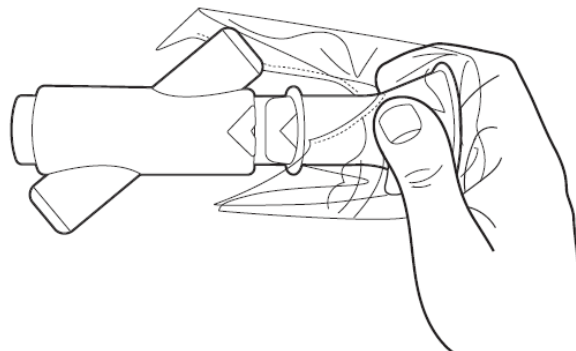
The spirettes/mouthpieces and nose clips are all single use. These can be disposed of in the household waste. Zip lock bags are supplied so they can be placed in these before disposal.

### **Calibration of your spirometer**

Your spirometer will be sent to you already calibrated. You will **NOT** need to calibrate it during fieldwork, unless Equipment contacts you about calibration.

### **Using the NDD equipment during the health visit:**

1. The lung function software can be launched from CAPI when you are in the Lung Function section.
2. Plug the spirometer into the USB port before launching the software.
3. Always ensure that the laptop is plugged in to charge when performing the lung function as this program tends to use up the battery life quite a bit, compared to other programs that are running.
4. Add a disposable filter to the end of spirometer.
5. Tear open the plastic outer packaging containing the spirette and partly unwrap it by folding the plastic wrapper back allowing you to insert the spirette into the spirometer. Ensure that the plastic wrapper protects the mouthpiece of the spirette (see pictures below) until you hand the spirometer to the participant. This ensures the mouthpiece of the spirette is hygienic and has not been contaminated before you hand it to the Participant.



6.

7. To insert the spirette into the spirometer, slide the cylindrical end of the spirette into the hollow of the spirometer. There is only one way that the spirette can be correctly locked into the spirometer, this is done by ensuring the triangle on the top of the spirette is aligned with the triangle on the top of the spirometer (see the picture below). The spirette is securely attached when these lock into each other and the spirette cannot rotate inside the spirometer.



#### Performing the test

5. Explain to the participant:  
**“We are now going to perform the lung function test which tells us how well people's lungs are working. It measures the amount of air you can blow out of your lungs and how fast you can blow the air out. On its own this test can't tell me if there are any problems with your lungs so if you have any concerns about your lungs you should talk to your GP.**  
  
**To do the test you will need to blow out into a tube as hard and as fast as you can for as long as you can. To get an accurate test you will need to blow at least 3 times and a maximum of 5 times.”**
6. The CAPI will ask a series of questions to assess for exclusions. The CAPI will instruct if the respondent cannot undertake the lung function test and will give you text to read out.
8. Check with the respondent whether:
  - They have had a cold, flu or sore throat in the past 14 days
  - They are asthmatic. If they are asthmatic, then ask if they are on medication and if they have had any symptoms in the past 12 months.

**Please note that if they reply yes to any of the 2 above, it does NOT exclude them from performing the test. It only serves as to a possible explanation as to why they may not perform as well as expected. If, however you feel their cold or asthma is too severe to perform the test, then use your judgement and exclude them accordingly.**

- Once you have completed these questions, you will need to explain how to perform the test:

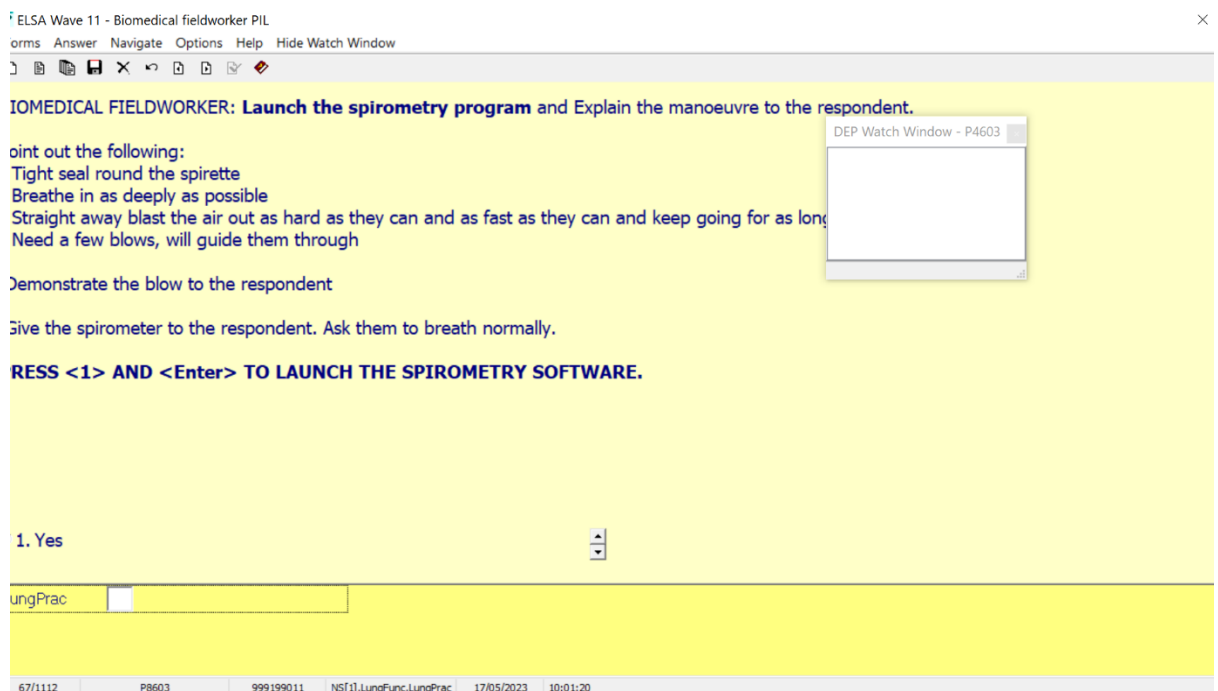
**“First you will need to take as full and as deep a breath as you can so as to fill your lungs to capacity. Then make a tight seal, with your lips, around the tube, place your tongue under the mouthpiece so you do not obstruct the opening of the mouthpiece. You will then need to blow out as hard, as fast and as long as you can, until you feel you cannot blow out anymore and I will let you know when you can stop.**

**We will be doing a minimum of 3 blows and a maximum of 5 blows. The aim is to try and get 3 blows of similar value. The program will let us know when we have 3 similar blows. I will also be encouraging you to blow for as long as possible while you are blowing. If however, at any point you feel that you cannot blow anymore, and I am still telling you to keep blowing, then just stop and take the mouthpiece out.**

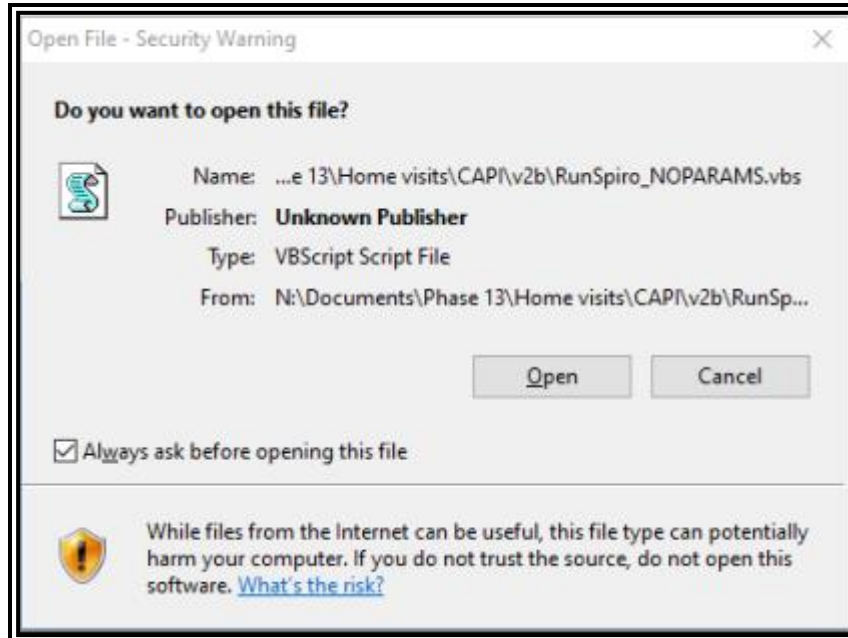
**You may feel slightly lightheaded whilst doing this.**

**If at any point you wish to stop the test completely or you feel you would rather sit to do the test, then just let me know.”**

- While providing this verbal demonstration, it is helpful for you to demonstrate the procedure to the participant, using your own spirette/mouthpiece.
- Ask the participant if they will be happy to do this after you have explained the procedure.
- If they are you are then taken to launch the Spirometry software from CAPI and will see the screen below:



13. When you select **1. Yes**, the spirometry software will be launched. You may see a pop-up box like the one below, just click on Open. If you unclick the 'Always ask before opening this file' box then you won't see this pop-up in future interviews.

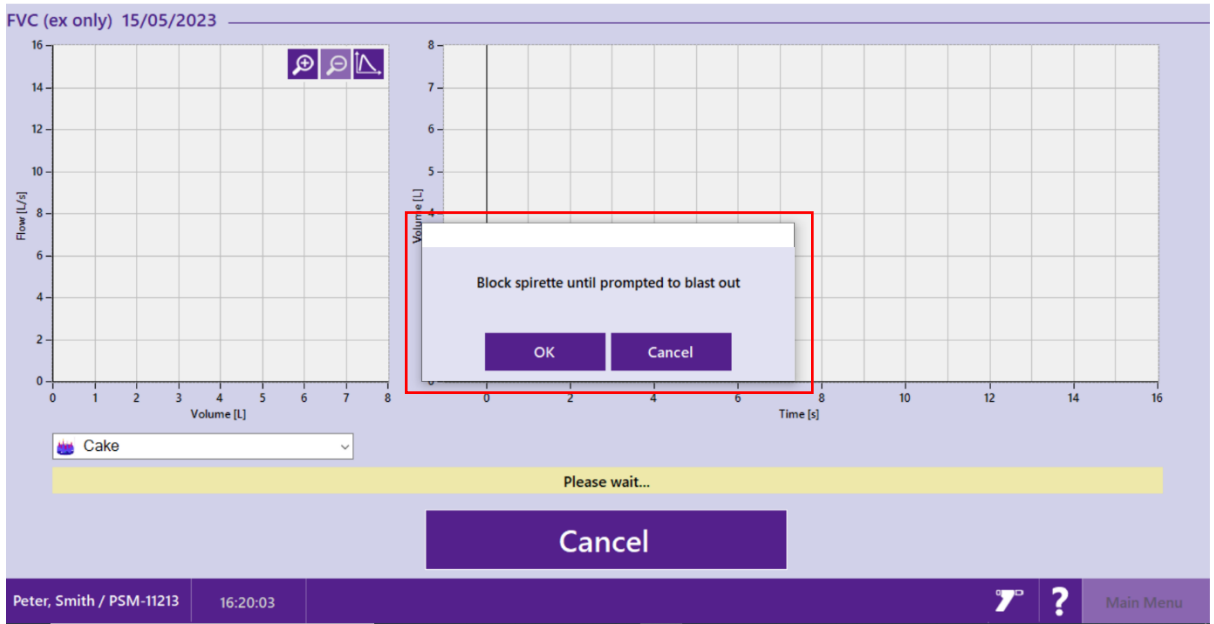


14. The first screen you will see will contain all the participants details. Please double check the name, serial number and DOB are the correct details for the participant you are visiting. The height and weight will be pre-populated from the measurements you conducted earlier in the screening.  
**You will need to Click on OK once you are ready to perform the test. Before clicking on OK it would be a good idea to get the participant to perform their practice blow to ensure that they have the correct technique. This will not count towards the number of blows they do.**

15. Once you have clicked on OK you will be prompted to choose a test. Please select **FVC (ex only)** test from the screen below

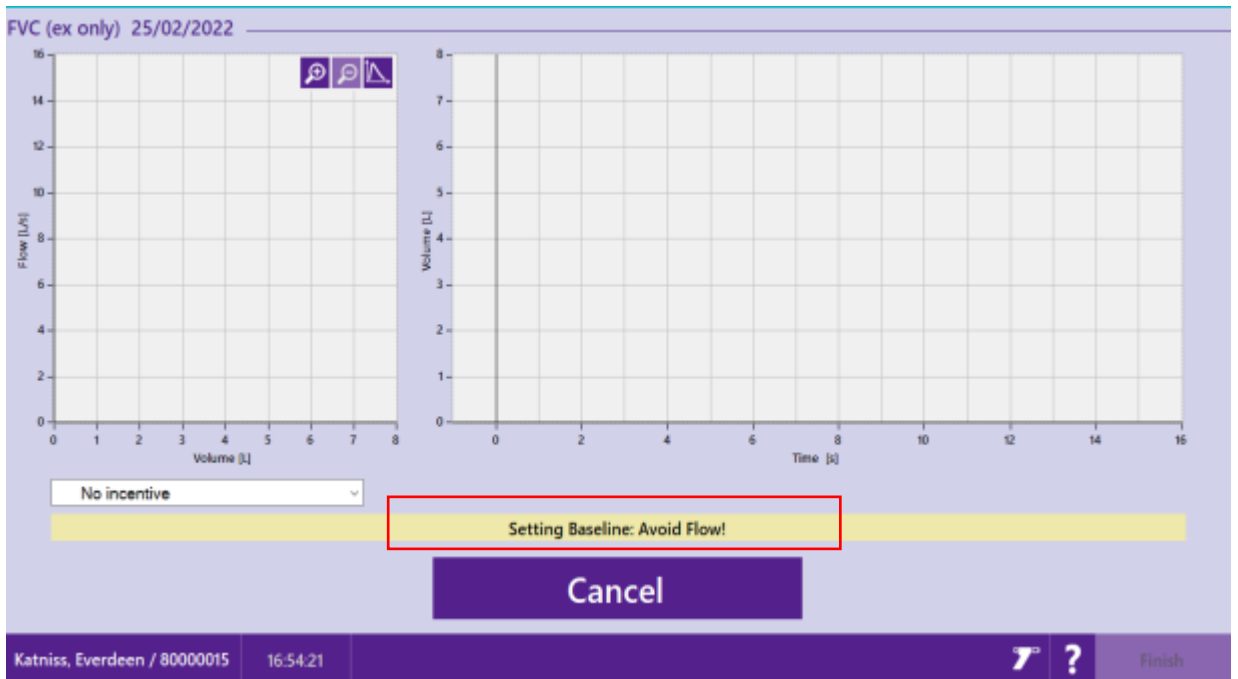
16. Once you have selected the test, you will be prompted to block the spirette to set the baseline.



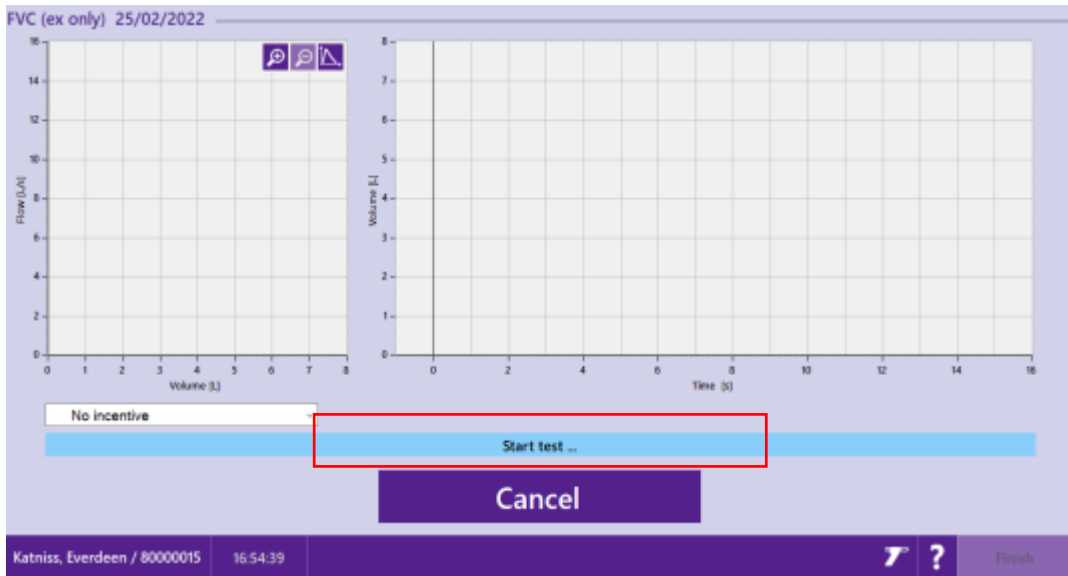


17. To block the spirette, you will need to place the palm of your hand over the back of the BVF and wait.

You will see the yellow line: **Setting baseline: Avoid flow!**



17. Once the baseline has been set you will be able to start the test.



18. Be aware that after approximately 30 seconds the screen above will time out and you will then see the screen below. You will then just need to click on **ADD TRIAL** to start again. It is important therefore that you keep an eye on the screen at this point.



19. Ensure that in the left-hand part of the screen you see either incentive which should be either the birthday cake with candles or elephants. The incentive is there to help encourage the participant to blow for as long as they can, in addition to your encouragement.

The aim is for the participant to blow all the candles out/fully wash the baby elephant. If either of these incentives do not appear, use the drop-down menu to select one of them.



20. Hand the respondent the spirometer. Remind the participant that they need to take a big breath in and start to blow in the mouthpiece. You can say:

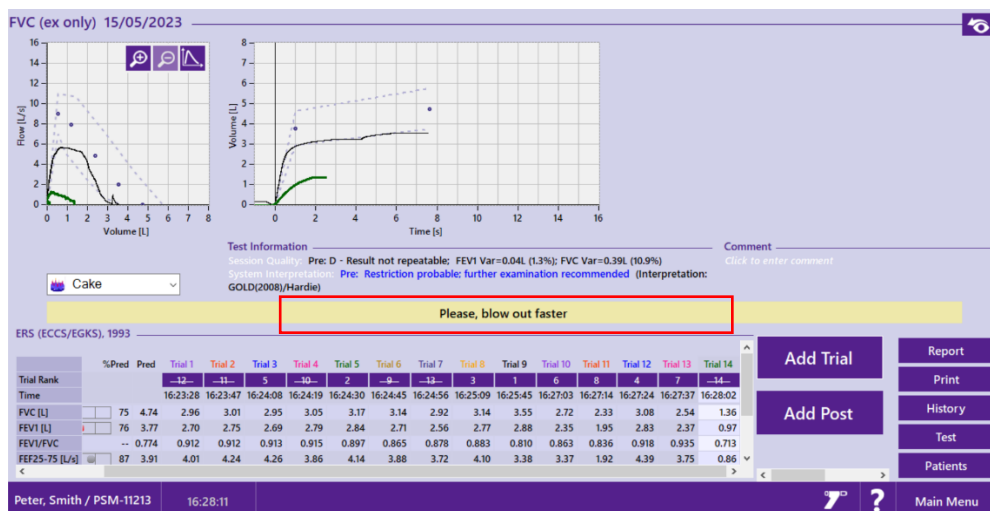
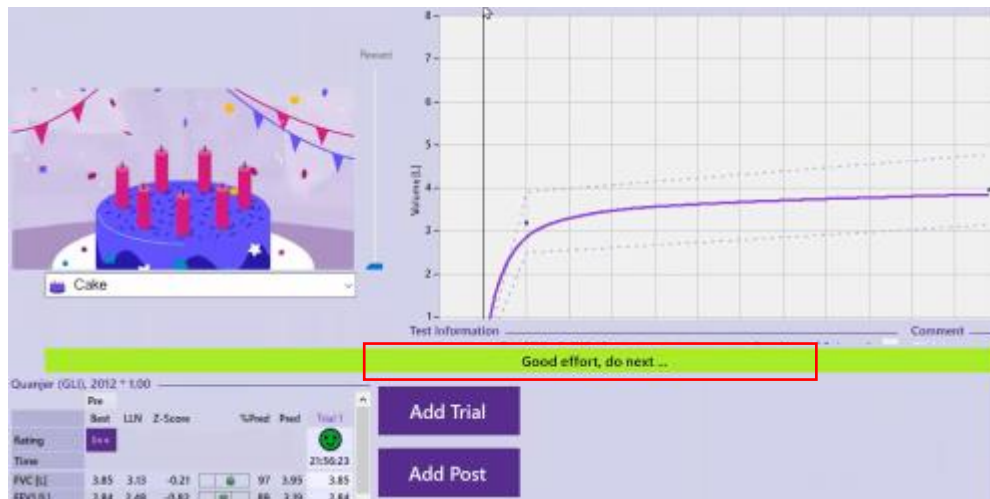
**“When you are ready, take a big breath in and blow”**

It is important to visibly observe the participant perform the maneuver, making sure that he/she appears to have taken a deep breath and correctly placed the mouthpiece and that they are tolerating the test. Do not stand in front of the participant when they are blowing, keep observing aside.

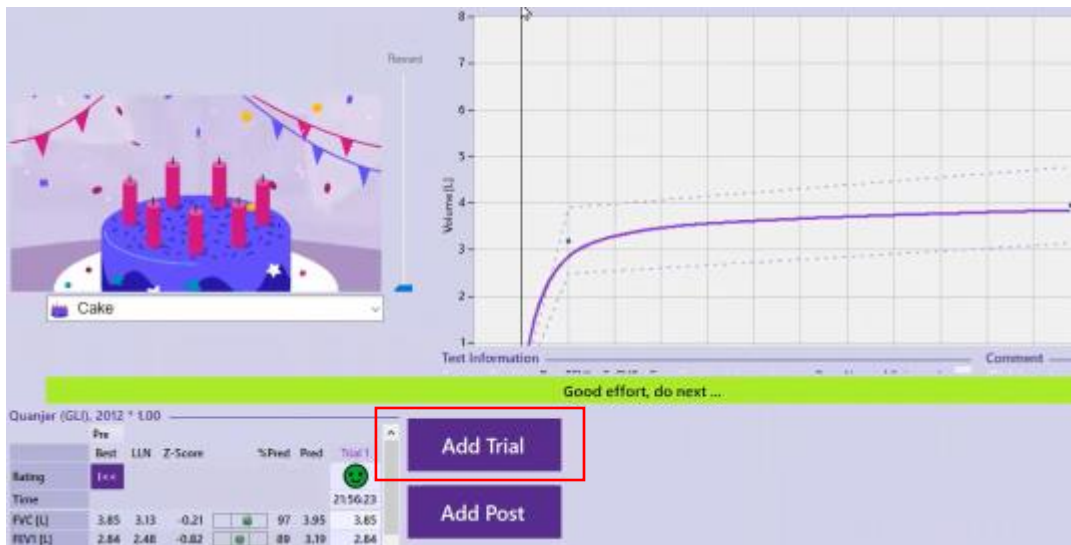
Give the participant enthusiastic verbal encouragement whilst they are blowing by saying:

**“Keep blowing, keep blowing”**

21. Encourage the participant to keep blowing until they feel that there is no more air in their lungs. If the participant is facing the screen, they will be able to see either the candles on the cake being blown out or the baby elephant becoming cleaner and the participant needs to keep blowing until all the candles are blown out or the elephant is completely clean, this is usually until the 6 second line, but not always. Most of the participants can blow longer.
22. Once the candles have been blown/baby elephant is clean, or the participant stops blowing before that, you will see the screen below. It tells you if the attempt was a good attempt, by saying **Good Effort, do next** or if the attempt needed some adjusting by saying **Please blow out faster** for example.



- It is important, before performing another attempt, to ask and check that the participant is okay to perform the next attempt. Please wait at least 1 minute between each attempt. After each attempt ask them if they are feeling ok, do they feel dizzy or do they need a bit more time to get their breath back. As the participants are older than at previous phases, it is very important that you give them a bit of extra time in between each attempt, some may need longer than others.
- If the participant is happy and okay to perform the next attempt, you will need to click on **ADD TRIAL** and repeat the test.



- Remember you need to perform a minimum of 3 attempts and a maximum of 5 attempts.
- If you see the message '**Session complete, good job**' at any point, you can stop the test. This means that you have been able to get 3 attempts which are similar in value.



- If you get to attempt 5 without seeing the message '**Session complete, good job**', you do not do anymore attempts. This will be the end of the test and you will move onto the hand grip test; the test is not discontinued.
- If the participant or you feel they cannot do any further attempts, and this is before attempting to do 5 attempts, **stop the test**.

You will then need to indicate that the test was **Discontinued**. Please write a short and concise message as to why the test was discontinued, as this allows us to understand what happened and why it was stopped early i.e. before 5 attempts were made.

30. The readings are automatically saved on the laptop and you will not need to note anything down separately.
31. To get back to CAPI, just close the Spirometry software by clicking on the X in the top Right-Hand corner.
32. Back in the CAPI questionnaire you will be asked if you have any feedback/notes about how the lung function test went. Please answer those noting any feedback or any issues you or the respondent may have experienced during the test.

### Possible error messages and program advice

The software has inbuilt advice to ensure a satisfactory blow is achieved. Below are some of the messages that can appear. There are also some error messages that appear which have been added to this list below.

Message	Reason	Advice
Don't hesitate or Patient hesitation detected	The participant exhaled air in short bursts The participant did not start blowing out as soon as they placed the mouthpiece in their mouth	Participant must breathe out (blast out) all the air at once, not in short bursts and as soon as they place the mouthpiece in their mouth
Blast out faster or Please blow out faster	The participant did not blast the air out fast enough from the start	The participant must blast out the air as fast as hard and as fast as possible
Blow out longer or Please blow out longer	The participant did not breathe out for long enough OR stopped when they still had air in their lungs	The participant needs to breathe out for longer and force out as much air from their lungs as possible
Test abrupt end or Abrupt end of test detected	The blow stopped sooner than was expected Participant may not have exhaled completely.	The participant needs to breathe out for longer and to force out as much air as possible from their lungs as possible
Good effort, do next...	The blow was acceptable	This is an acceptable blow. They need two more of these for the overall session to be complete
Cough detected.	The participant coughed while blowing	The participant needs to avoid coughing if possible.
Tidal breathing	The participant did not use the correct technique and kept breathing in and out	The participant needs to blow out in one long breath and continue until they feel they can not blow anymore or until they pop the balloon
Device Error	There is a problem with the sensor (spirometer), it is not being detected.	Check that the sensor is correctly connected and try again.

Diagram showing the full test flow below

