



# PVDOMICS: CPET Training

Cardiovascular Physiology Core  
Cleveland Clinic, Cleveland OH  
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## **NHLBI Pulmonary Vascular Disease Phenomics Program**

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# Equipment and Supplies

## A. Cycle ergometer

- Mechanical or electromagnetically braked (the electronically braked ergometer is strongly preferred because of its compatibility with incremental protocols)
- Upright cycle ergometer
  - Supine bicycle is an acceptable alternative, especially for invasive CPET
- Capable of calibration
- Handlebars and seat that adjust to height

# Equipment and Supplies

B. ECG system

C. Blood pressure

- Sphygmomanometer (cuff measurement method)
- Direct method using in-dwelling arterial catheter

D. Gas analyzers

E. Flow measurement device

- May be provided as part of a commercial metabolic exercise system

F. Data-acquisition computer, monitor and keyboard

G. Resuscitation cart

# Equipment and Supplies

- H. Supplemental O<sub>2</sub> equipment and delivery systems
- I. Pulse oximeter finger or ear probes
- J. Chart displaying the Borg RPE scale (Appendix 1 in the MOP chapter)
- K. Barometer (or other valid method to obtain barometric pressure) and accurate thermometer

# Borg Rate of Perceived Exertion (RPE) Scale

|     |                                                      |
|-----|------------------------------------------------------|
| 0   | Nothing at all                                       |
| 0.5 | Very, very slight shortness of breath                |
| 1   | Very mild shortness of breath                        |
| 2   | Mild shortness of breath                             |
| 3   | Moderate shortness of breath or breathing difficulty |
| 4   | Somewhat severe                                      |
| 5   | Strong or hard breathing                             |
| 6   |                                                      |
| 7   | Severe shortness of breath or very hard breathing    |
| 8   |                                                      |
| 9   | Extremely severe                                     |
| 10  | Shortness of breath so severe you need to stop       |

# Equipment Quality Control

- The CPET machine should be regularly checked for quality control and maintained as per the manufacturer's recommendations.
- Biological control checks should be done at least once every 6 months
- Follow your normal site protocols

# Site Certification

- Before CPET studies are performed on participants, each site needs to:
  - Review and become familiar with study procedures
  - Establish a primary contact person at their site who will be responsible for communication with and transmission of data to the data coordinating center (DCC).
  - Submit one non-invasive CPET test on a “standard normal participant”. The standard participant should be a healthy adult. You may use a laboratory employee for qualification testing if you like.
  - Await feedback from the core laboratory confirming that their site has qualified prior to scheduling study participants for testing.

# Subject Preparation: Pre-Test Instructions

- Identify the participant using two separate identifiers.
- Check to make sure that a current signed consent is on file for the participant.
- Record recent medications taken, the last time participant ate and the last time participant exercised.
  - Each participant may have a different definition of “exercise”. This is okay, we are interested in ascertaining if they have recently tired themselves out.
- Record any current symptoms (e.g. dyspnea, wheezing, chest pain, leg pain, etc.).

# Subject Preparation: Pre-Test Instructions

- Explain the purpose of the test. Explain that it is a maximum stress test and that the mouthpiece or mask must be in place for the duration of the test.
- Explain the end-points (attainment of maximal heart rate, development of limiting symptoms, or out of range measurements on blood pressure, ECG, or O<sub>2</sub> saturation).
- Reassure the participant about safety.

# Subject Preparation: Pre-Test Instructions

- Explain the Borg scale.
- The participant will need to **point** to the number they feel best represents how hard they are exercising each time you ask them.
- They need to point to the number because they cannot talk during the test. They'll have a mouthpiece or mask monitoring their breathing

|     |                                                      |
|-----|------------------------------------------------------|
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# Subject Preparation: Pre-Test Instructions

- Things to keep in mind
  - Although sometimes uncomfortable, the mouthpiece is preferred to the mask since leaks can occur with the mask and cause erroneous results.
  - It's a good idea to go through alternative communication signals with the participants (such as pointing at a number on the RPE scale rather than saying it) so they feel comfortable not talking.
  - For pulse oximetry, an ear probe is preferred over a finger probe because the contraction of the hand muscles while holding the handlebar of the cycle can alter blood flow to the finger.

# Selecting the Exercise Protocol

Ask each participant:

1. Do you become short of breath or fatigued when you walk around your house?
  - NO → ask question 2
  - YES → select a 10 Watt continuous ramp protocol
2. Are you able to climb 1 flight of steps without becoming short of breath or fatigued?
  - NO → select a 15 Watt continuous ramp protocol
  - YES → Select a 20 Watt continuous ramp protocol

# Procedure Notes

- Several factors can influence test results, including:
  1. Participant effort
    - Participant should be encouraged to give a maximal performance, unless early termination is warranted.
    - RER equal to or greater than 1.10 to 1.15
  2. Medications
    - Beta-blockers,  $\text{Ca}^{2+}$  channel blockers and others may affect the heart rate response.
    - Bronchodilators may affect the ventilatory response
  3. Participant performance, coordination, and physical limitation with a particular exercise device can affect results
    - e.g. inability to coordinate pedaling effort or orthopedic constraints
  4. Leaks associated with participant, connection interface, tubing or valves.

# Procedure Notes: Form 290

- You'll need to fill out Form 290 both in paper and in the electronic database
- Form 290 is under revision after recent protocol changes to the exercise ramp

Revision of 08/24/2016



Form #290  
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## **PVDOMICS STUDY** **Center Cycle Ergometer Cardiopulmonary** **Exercise Test (CPET) Procedure Notes #290**

**Instructions:** Review PVDOMICS MOP Chapter prior to completing Cardiopulmonary Exercise Test (CPET). This worksheet/form is used for either non-invasive or invasive CPET results. CPET results are reported on Form 291.

# CPET Transmission to the CPC

## 1. De-identify the CPET file

- If this CPET was done for research only, then it should not contain any identifying information.
  - If there is identifying information anywhere in the file it should be removed/deleted before being sent to the DCC
- Verify that each CPET file contains the participant's 6 digit ID #, their 2 letter alphacode and the date of the CPET test somewhere
  - If one of the 3 elements mentioned above is missing and there is no suitable field to add it to (e.g. name), add the necessary element into a notes field

# CPET Transmission to the CPC

2. Name the CPET file according to the following convention:

CPET\_#####\_ac\_mmddyyyy.cow

↑                    ↑                    ↑                    ↑                    ↑  
Type of Test                    PVDOMICS ID#                    Alphacode                    Date of Test                    File Type

# CPET Transmission to the CPC

## 3. Submit CPET to DCC.

- Log in to SSH with your assigned account name and password
- Drag and drop the CPET file into SSH home directory for PVDOMICS on DCC server
- DCC will then move the file out of the home directory for processing

## 4. Complete Form 290 and enter it into the PVDOMICS Study database.

## 5. File the paper copy of Form 290 in the participant's study record.



# For Questions Please Contact

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