# Cardiovascular Health risk & HRV

What is it?

Cardiovascular disease refers to any disease that affects the cardiovascular system, principally heart disease, vascular diseases of the brain and kidney, and peripheral arterial disease. Although cardiovascular disease is a chronic condition that progresses over the course of many years, death often occurs suddenly and before medical care is available so that many therapeutic interventions cannot be applied or are only palliative. While the causes of cardiovascular disease are diverse, the prevention of it represents one of the most important aspects of medicine today. Treatment decisions are based on the likelihood that an individual will have a cardiovascular event over a given period of time. Assessment of cardiovascular health risk is the starting point for discussions between health-care providers and individuals who are potentially at significant risk of a cardiovascular event.
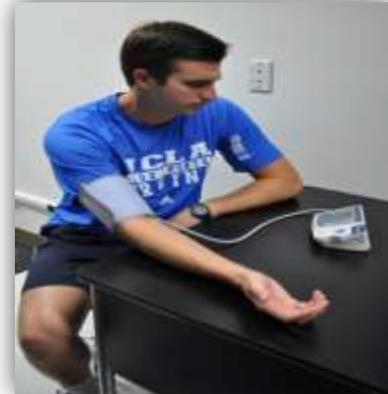
Why is it important?

The facts are distressing:

- Approximately 84 million people in the US suffer from some form of cardiovascular disease, causing 2,200 deaths a day, averaging one death every 40 seconds
- It is estimated that if all forms of major CVD were eliminated, life expectancy would rise by almost 7 years
- Almost one out of three deaths results from CV disease, more than cancer, COPD and accidents combined
- The direct and indirect costs of CV disease are about half a trillion dollars and this figure is increasing annually

A risk factor is a characteristic that is present early in life and is associated with an increased risk of developing future disease. Risk of CVD can be determined through evaluation of traditional risk factors (non-modifiable and modifiable) and through screening evaluations. Non-modifiable risks include age, heredity, race and gender. A modifiable risk factor is one that can be minimized by diet, exercise and personal habits. Modifiable risk factors deserve a great deal of attention because altering these can influence the likelihood of developing CVD. There are six major modifiable risk factors: smoking, hypertension (high blood pressure), hypercholesterolemia (high cholesterol levels), diabetes or impaired glucose tolerance, obesity, and lack of physical activity. The more risk factors an individual has, the greater the likelihood that he or she will suffer from CVD. This assessment will ascertain the following risk factors:

Blood Pressure: Hypertension refers to a chronic, persistent elevation of blood pressure. High blood pressure is called the "silent killer" because it often has no warning signs or symptoms, and many people do not realize they have it. Hypertension causes atherosclerosis by damaging the lining of blood vessels (endothelium). If untreated, around 50% of hypertensive individuals will die from coronary heart disease, another 33% from stroke, and 10-15% from renal failure.

Cholesterol: Cholesterol is vital for cell membranes and hormone synthesis, but when present in excessive amounts, it can have negative health outcomes. Elevated levels of triglycerides and LDL-cholesterol are associated with increased risk of CVD, while increased levels of HDL-cholesterol are associated with a decreased risk of cardiovascular disease. The increase in risk of cardiovascular disease increases progressively with increasing levels of total cholesterol; there is a 20 to 30 percent increase in risk for coronary heart disease for every 10 mg/dL increase in total cholesterol.

Blood Glucose: Diabetes is a metabolic disorder characterized by the inability to process sugar (glucose) effectively. The risk of cardiovascular events is two to three times higher in people with diabetes and the risk is disproportionately higher in women. Furthermore, 65% of all deaths among diabetic patients are from CVD.

Body Mass Index: Body Mass Index (BMI) is used to provide an estimate of total body fat and is calculated by dividing bodyweight by the height squared. This simple measure has recently provided

evidence that approximately 34% of Americans are obese (have BMI's >30 kg/m²) and another 30-35% are overweight (BMI>25kg/m²). Obesity not only exacerbates other major cardiovascular risk factors, such as elevated blood pressure, glucose intolerance, type II diabetes and dyslipidemia, but it also exerts an independent influence on the risk of cardiovascular disease by increasing the work the heart must perform to circulate blood through the body.

Resting Heart Rate and EKG: Resting Heart Rate (RHR) is a measure of how hard your heart is working when the body is at rest and is a direct reflection of physical fitness. Research indicates that elevated resting heart rate (RHR) is an independent risk factor in individuals with coronary artery disease, myocardial infarction and congestive heart failure. In fact in increase in RHR of 10 bpm is associated with almost 10-30% increased risk of all-cause mortality and a 20-30% increased risk for cardiovascular events in the healthy population.

Heart Rate Variability: Also modulated by physical activity, Heart Rate Variability is the degree to which the heart rate varies from beat to beat and provides an indication of the sympathetic and parasympathetic neural influences on heart rate. The last three decades have witnessed the recognition of a significant relationship between autonomic nervous system dysfunction, as measured by HRV, and risk of cardiovascular morbidity and mortality. Low HRV is associated with a 32-45% increased risk of a first cardiovascular event in individuals without known cardiovascular disease.

VO2max: VO2max is a parameter of aerobic performance that identifies functional capacity (physical work) of the integrated pulmonary, cardiovascular, and skeletal muscle systems. It is known to be a more powerful predictor of mortality among men than any other established risk factors for cardiovascular disease. The risk of CVD in inactive people is about twice that of physically active individuals and is responsible for approximately 200,000 deaths per year in the United States.

How is it assessed?

The goal is to procure the 'initial' assessment of your risk of developing cardiovascular events. It provides the foundation for targeted preventative efforts based on your predicted risk score. Moreover, this assessment is designed to aid the individual and health-care provider in informed decision making about lifestyle interventions to mitigate the risk of CV disease.   Intuitive and easy to use, it takes into account the multifactorial nature of CVD. It allows flexibility in management so that when you cannot reach the ideal level in one factor of risk, you can reduce your overall risk for CVD by addressing other risk factors.

The UC Fit Health and wellness report summarize your health status based on the most relevant cardiovascular risk factor measurements. One of the elements of the report is the Total Score, which is calculated by evaluating the latest measurements from five "Tier-1" physiological variables: resting blood pressure, fasting blood glucose, serum cholesterol, aerobic capacity (VO2max) and body mass index. These variables were selected to contribute to the Total Score because of **significant prior clinical validation** as predictors of CVD. These variables are weighted following an evidence-based proprietary algorithm to determine your Total Score.

Your assessment will include the following:
1. Blood Pressure: Using an automated sphygmomanometer cuff
2. Cholesterol (skin)*: not available yet
3. Blood Glucose: Using a handheld glucometer with a finger stick and test strips
4. Body Mass Index: Using standard height and weight measures
5. VO2max (predicted using app): A 10 min, incremental treadmill test using an automated app (Digital Health Network – DHN) connected to a wearable Physiological Status Monitor (PSM) that measures your heart rate
6. Resting Heart Rate and EKG: Using a wearable Physiological Status Monitor (PSM) and an automated app (Digital Health Network – DHN)
7. Heart Rate Variability: A 7 min resting test using a wearable PSM and DHN app
8. Framingham Risk Score: Using a evidence-based software program (app) on EPRL iPad
9. VO2max (predicted using app): A 10 min, incremental treadmill test using a DHN app connected to a wearable PSM that measures your heart rate

What to expect during the assessments:
1. The last and most physically strenuous of the assessments will be the VO2max test.
2. The VO2max test starts with you walking on a treadmill or riding a stationary bike; as the test progresses, the workload will gradually increase (i.e., faster speed and/or steeper incline every minute) until you can no longer maintain it and the test will cease.
3. **You may choose to stop the test at any time, although for meaningful results, you should continue exercising for as long as possible to achieve an accurate VO2max**

Participant preparation:
Test validity and data accuracy are greatly improved by adhering to the following guidelines prior to your assessment. Your test(s) will be given on the assumption that you have followed these recommendations:
1. Refrain from ingesting <u>heavy</u> meals, alcohol, caffeine and tobacco products within 5 hours of testing
2. You should be well rested for the test: avoid significant exertion or exercise 24 hours prior to testing and get a good night's sleep
3. Drink ample fluids over the 24-hour period preceding the assessment to ensure normal hydration
4. Clothing should permit freedom of movement and be appropriate for exercise