Cardiac Rehabilitation and Secondary Prevention: Get Pumped Up About Heart Health

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Christiana Care Health System
Heart Disease remains the #1 cause of death in the United States.

Coronary heart disease accounts for 1 in 7 deaths in the US, killing over 366,800 people a year.

Approximately every 40 seconds, an American will have a heart attack.

The estimated direct and indirect cost of heart disease in 2013 to 2014 (average annual) was $204.8 billion.
Anatomy

The heart is about the size of your fist and sits in your upper chest with your ribs surrounding it for protection.

On either side of the heart is the lungs, spinal cord and at the bottom is the diaphragm.

This upper cavity/area is called the thorax.
Electrical Conduction

sinoatrial node
(Keith and Flack node)

1

pathways

atrioventricular node

2

bundle of His

left bundle branch and
right bundle branch
How the Heart Works
Circulation
Who can participate in CR&SP?

- Recent Heart Attack
- Coronary Artery Bypass Surgery
- Heart Valve Repair/Replacement
- Heart Angioplasty/Stenting
- Heart or Heart-Lung Transplant
- Stable Angina
- Compensated Heart Failure

Some commercial insurances recognize additional cardiac diagnoses
Angina usually occurs when narrowed coronary arteries can’t deliver enough oxygen-rich blood to the heart muscle.

- The arteries may be narrowed because of:
  - Atherosclerosis.
  - Blood clots.
  - Spasms of the artery.
Angina Symptoms

- Chest discomfort.
- Chest tightness.
- Chest fullness.
- Chest burning.
- Chest pain.
- Chest squeezing or pressure.
- Indigestion.
- Shortness of breath.
- Pain felt in the neck, jaw, arms, shoulder or back.
- Extreme fatigue
- Cold sweat
Immediate Treatment of Angina

1. Stop what you are doing. Sit or lie down. Rest!

2. If your doctor has prescribed nitroglycerin, follow these steps:
   - Place one nitroglycerin tablet (or one spray) under your tongue. Wait three to five minutes.
   - If your angina does not go away five minutes after taking your first nitroglycerin, call 9-1-1 for an ambulance to take you to the hospital, and put a second tablet (or spray) under your tongue. Wait three to five minutes.
   - If you still have angina, place a third tablet (or spray) under your tongue.

3. If you do not use nitroglycerin and you have angina, call 9-1-1 immediately.
Myocardial Infarction (MI)
Rupture of Plaque

Plaque with fibrous cap

Cap ruptures

Blood clot forms around the rupture, blocking the artery
MI Evaluation

- Physical Assessment
- Blood Studies
- EKG
Typical Treatment for Coronary Blockage

- Thrombolytic therapy
- Percutaneous Coronary Intervention (PCI)
  - Percutaneous Transluminal Coronary Angioplasty (PTCA)
  - Stenting
- Coronary Artery Bypass Graft (CABG)
Coronary Stent
Coronary Artery Bypass Graft (CABG)
Triple Bypass
Valve Stenosis & Regurgitation

- **Normal Aortic Valve**: Open and closed states.
- **Aortic Valve Stenosis**: Open and closed states with an arrow indicating regurgitation.

© Allina Health System
Heart Valve Repair/Replacement
Heart Failure

Diastolic
- Stiff and thick chambers
- Heart can't fill

Systolic
- Stretched and thin chambers
- Heart can't pump
Left Ventricular Assist Device
Cardiac Rehabilitation & Secondary Prevention
History of CR & SP

- 1930s – 6 weeks of bed rest
- 1940s – physical activity introduced
- 1950s – 5 minutes of daily walking at 4 weeks post MI
- 1960s – Inpatient cardiac rehabilitation programs started.
- 1970s – outpatient monitored exercise
- 1980s – CR evolved from just focusing on exercise to a comprehensive medical and lifestyle modification model.
- 1990s – The first Clinical Practice Guidelines for Cardiac Rehabilitation broadened the scope of cardiac rehabilitation.

What is Cardiac Rehabilitation and Secondary Prevention?

It is a patient-centered, comprehensive, multidisciplinary, secondary prevention program.
What is Secondary Prevention?

- **Secondary prevention** attempts to identify a disease at its earliest stage so that prompt and appropriate management can be initiated.

- Successful secondary prevention reduces the impact of the disease by managing it in the earliest stage.
The Goals of CR&SP

- CR/SP provides empowerment to our patients to understand Heart Disease and what can be done to control it.
  - Know your numbers
  - Understand what those numbers mean
- CR/SP provides a safe, controlled atmosphere staffed with healthcare professionals.
- CR/SP helps patients optimize their physical abilities and improve quality of life.
Studies:

- **3 x** Increased likelihood of readmission for CABG patients who do not attend CR&SP compared to those who do attend.
- **46%** 10-year relative risk reduction in all-cause mortality due to participation in CR&SP following CABG.

Studies:

- **25-31%** reduction in hospital readmissions in those who participated in CR & SP

- **31%** decreased number of days of rehospitalizations shown with participation in CR & SP following MI or CABG

- **45-47%** reduction of all cause mortality following PCI


Medicare: Comparison of # Sessions

1 session - 14% lower risk of death
12% lower risk of MI

12 sessions - 22% lower risk of death
23% lower risk of MI

36 sessions - 47% lower risk of death
31% lower risk of MI

Hammill BG, Curtis LH, Schulman KA, Whellan DJ. Relationship Between Cardiac Rehabilitation and Long-Term Risks of Death and Myocardial Infarction Among Elderly Medicare Beneficiaries. Circulation. 121(2010); pp 63-70.
CR & SP: a Class 1A Treatment

- **56%** AHA “Get With the Guidelines” found that nationally only 56% of eligible patients were referred to CR & SP prior to hospital discharge.

- Compared to other proven Class 1 therapies prior to discharge:
  - **98%** aspirin use
  - **93%** beta-blocker use
  - **84%** ACE inhibitor/ARB use

Source:
The Phases of CR&SP

- Phase 1 - in hospital
- Phase 2 - out-patient
- Phase 3 - maintenance
Overview of Inpatient CR&SP program

Order sets include CR & SP consults for inpatient and outpatient programs.

Inpatient staff provides the following services:

- Assess and assist with activity
- Evaluate need for discharge O2 support and for assistive devices with ambulation
- Provide patient/family with discharge instructions and education for safe activity guidelines
- Refer patient to outpatient CR
What to Expect from Outpatient CR&SP

- CR & SP is a supervised, monitored, individualized exercise program with integrated Secondary Prevention education and counseling.

- Provides case-management, allowing for interventions that may prevent rehospitalization and empowering patient to understand and manage their disease.

- Program is typically 3 days a week for 3 months (total 36 sessions). However, tailored to individual needs.

American Association of Cardiovascular and Pulmonary Rehabilitation. Guidelines for Cardiac Rehabilitation and Secondary Prevention Programs, Fifth edition
Outpatient CR&SP

- Initial assessment
  - Thorough H&P
  - Medication Reconciliation, also done daily
  - The Individual Treatment Plan (ITP) will address and follow Goals, Interventions, Education, Reassessments and Final Assessment for:
    - Exercise
    - Nutrition
    - Psychosocial
    - Other Core Measurements/Risk Factors (ie - DM, HTN, CHF)

- Orientation to exercise program
- Daily assessments (ie – dysrhythmias, pain/symptoms, hemodynamics, weight, blood sugar, medications, etc.)
Outpatient CR&SP

- **Education (incorporated throughout the program)**
  - Patient Education Packet
  - Individual and group education provided and evaluated
  - Family/Support persons encouraged to participate

- **ITP reviewed at least monthly with Medical Director**
  - Communication with cardiologist as needed, but minimum is:
    - Start of program
    - Mid program
    - Completion of program with data provided

- **At completion of program:**
  - Post data obtained
  - Individualized exercise prescription
  - ITP reviewed with patient, discuss achievements and future goals
Outpatient CR&SP

- The exercise program is individualized to optimize functional capacity.
- Exercise Prescription follows most recent ACSM/AHA/AACVPR guidelines, tailoring the exercise program to enhance and progress all levels of physical abilities, in a safe manner.
  - Frequency
  - Intensity
  - Time
  - Type
  - Volume
  - Progression
- Strong focus on incorporating safe home/independent activity.
Benefits of CR&SP
Components

• The benefits realized at CR & SP programs are a combination of all CR & SP components.
  • Approximately half of the mortality reduction achieved by exercise-based cardiac rehabilitation can be attributed to reductions of major risk factors.
  • Other factors may also contribute to the benefits of CR/SP:
    • reduction in inflammation
    • ischemic preconditioning
    • improved endothelial function
    • a more favorable fibrinolytic balance

Core Components of CR&SP

- Physical Assessment
  - Exercise Training
  - Physical Activity Counseling
  - Psychosocial Management
  - Tobacco Cessation
  - Diabetes Management

- Nutrition Counseling
  - Weight Management
  - Blood Pressure Management
  - Lipid Management
Physical assessment
Patient Assessment

- **The first appointment is with a Registered Nurse (RN):**
  - History and Physical
  - Review Medications
  - Discover preferred method of learning
  - Assess for learning barriers
  - Together create goals and plans to achieve these goals

- **RN Case Management throughout program:**
  - Daily assessment
  - Assessing and reassessing educational needs
  - Physician communication
  - Teach patient how to take control of disease
    - Understand how to self-assess, become aware of signs and symptoms and what to do.
Nutrition

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>2,000</th>
<th>2,500</th>
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<tbody>
<tr>
<td>Calories</td>
<td>2,000</td>
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</tr>
<tr>
<td>Total Fat</td>
<td>Less than 65g</td>
<td>80g</td>
</tr>
<tr>
<td>Sat Fat</td>
<td>Less than 20g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>2,400mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g</td>
<td>375g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>25g</td>
<td>30g</td>
</tr>
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</table>

ChooseMyPlate.gov
The DASH Diet for Healthy Blood Pressure

Follow these DASH (Dietary Approaches to Stop Hypertension) guidelines for a healthier, more balanced diet.

- **Grains**: 6 to 8 servings per day
- **Lean Protein**: 6 or less servings per day
- **Legumes or Nuts/Seeds**: 4 to 5 servings per week
- **Fresh Fruits and Vegetables**: 4 to 5 servings of each per day
- **Low-fat Dairy**: 2 to 3 servings per day
- **Fats and Sweets**: Limited

OhioHealth

Discover how the DASH Diet can help you manage your blood pressure at blog.ohiohealth.com
Nutrition Counseling

- We review eating habits at the start of the program.
  - Determine where changes can be made specific to risk factors (i.e., Diabetes, Hypertension, Heart Failure, Kidney Disease)
  - Reassess eating habits at end of program
- We provide Nutrition Classes taught by a Registered Dietician.
  - Heart Healthy Nutrition Class monthly
  - Heart Failure Nutrition Class monthly
- Nutrition topics are discussed in exercise room to generate conversation.
- Opportunity for 1:1 sessions with Registered Dietician
Being obese can:
- raise blood cholesterol and triglyceride levels.
- lower your “good” HDL cholesterol level.
- increase blood pressure.
- induce diabetes. In some people, diabetes makes other risk factors much worse. The danger of heart attack is especially high for these people.
- Obesity increases the risk for heart disease and stroke. But it harms more than just the heart and blood vessel system. It's also a major cause of gallstones, osteoarthritis and respiratory problems.

### Weight Management and Body Mass Index

<table>
<thead>
<tr>
<th>BMI</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5 to 24.9</td>
<td>Normal weight</td>
</tr>
<tr>
<td>25 to 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30+</td>
<td>Obesity (including extreme obesity)</td>
</tr>
<tr>
<td>40+</td>
<td>Extreme obesity</td>
</tr>
</tbody>
</table>
Weight Management

- We get some information when starting the program:
  - Body Mass Index
  - Waist Circumference
  - Rate Your Plate Questionnaire

- We then set realistic and reasonable goals.
  - Loss of 1-2 pounds a week

- Nutrition Counseling
- Establish a consistent exercise program
- We track progress by repeating these measurements at the end of the program
**Blood Pressure**

- Blood pressure is recorded as two numbers:
  - **Systolic blood pressure** (the upper number) — indicates how much pressure the blood is exerting against the artery walls when the heart beats.

  - **Diastolic blood pressure** (the lower number) — indicates how much pressure the blood is exerting against the artery walls while the heart is resting between beats.

- **Hypertension**

- **Hypotension**

<table>
<thead>
<tr>
<th>BLOOD PRESSURE CATEGORY</th>
<th>SYSTOLIC mm Hg (upper number)</th>
<th>DIASTOLIC mm Hg (lower number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>LESS THAN 120</td>
<td>LESS THAN 80</td>
</tr>
<tr>
<td>ELEVATED</td>
<td>120 - 129</td>
<td>LESS THAN 80</td>
</tr>
<tr>
<td>HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1</td>
<td>130 - 139</td>
<td>80 - 89</td>
</tr>
<tr>
<td>HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2</td>
<td>140 OR HIGHER</td>
<td>90 OR HIGHER</td>
</tr>
<tr>
<td>HYPERTENSIVE CRISIS</td>
<td>HIGHER THAN 180</td>
<td>HIGHER THAN 120</td>
</tr>
</tbody>
</table>

(consult your doctor immediately)
Blood Pressure Management

- Blood Pressure medication dosages are directed by physician
- B/Ps done daily
- Review Medications
  - Education
  - If taken consistently
- Education
  - Provide education about high and low blood pressure
    - Understand what the numbers mean.
- Communicate with Physician
  - Too high or too low
What are Lipids

- **Total Cholesterol**: A person’s total cholesterol score is calculated by adding their HDL and LDL cholesterol levels and 20 percent of their triglyceride level. Total cholesterol levels are considered in context with other risk factors, and treatment is recommended accordingly.

- **HDL - High Density Lipoprotein (healthy)**: Think of it as the “healthy” cholesterol, so higher levels are better. Experts believe HDL acts as a scavenger, carrying LDL cholesterol away from the arteries and back to the liver. There it’s broken down and passed from the body.

- **LDL - Low Density Lipoprotein (lousy)**: Think of it as less desirable or even lousy cholesterol, because it contributes to fatty buildups in arteries.

- **Triglycerides**: Triglycerides are the most common type of fat in the body; they store excess energy from your diet. A high triglyceride level combined with low HDL cholesterol or high LDL cholesterol is linked with fatty buildups in artery walls. This increases the risk of heart attack and stroke.

American Heart Association
Lipid Management

- Cholesterol medication dosage is directed by physician
- Review Medications
  - Education
  - If taken consistently
- Education
  - Review lipid levels pre and post
    - Understand what the numbers mean
  - What can be done to improve lipids
What is Diabetes

- Diabetes is a chronic disease that happens when the body can’t make enough of the hormone insulin or can’t properly use the insulin it has.
- Insulin helps the body digest sugar (glucose) that comes from food and drinks, which is then used for energy.
- Without enough insulin, glucose builds up in the body, which over time can damage your nerves, blood vessels, heart and kidneys.

- Type I Diabetes
- Type II Diabetes
Diabetes Management

- Diabetic medication and dosages are directed by physician
- Check blood sugars before and after exercise
- Education
  - Blood sugar monitoring and frequency
    - Signs and symptoms of hypoglycemia and hyperglycemia
  - Medication
  - Diet
    - May refer to Registered Dietician
  - Living with Diabetes Program at PMRI
- Communicate with family doctor or endocrinologist any concerns or abnormal results
Tobacco Cessation

- Smoking is the most preventable cause of premature death in the United States.
- Almost one third of deaths from coronary heart disease are attributable to smoking and secondhand smoke.
- Smoking decreases your tolerance for physical activity and increases the tendency for blood to clot.
- It decreases HDL (good) cholesterol.
- Risks increase greatly if you smoke and have a family history of heart disease.
- Smoking also creates a higher risk for peripheral artery disease and aortic aneurysm.
- It increases the risk of recurrent coronary heart disease after bypass surgery, too.
Tobacco Cessation

- Review smoking status and other tobacco products
- Determine Readiness to Quit
  - Stage of Change
- Connect patient with a smoking cessation counselor
  - Individual education and counseling provided
  - Pharmacological support
- Assess progress and Stage of Change throughout the program
Psychosocial Management: Stress

- Stress is your body’s response to change. The body reacts to it by releasing adrenaline (a hormone) that causes your breathing and heart rate to speed up, and your blood pressure to rise. These reactions help you deal with the situation — the "fight or flight" response. The problems come when stress is constant (chronic) and your body remains in high gear, off and on, for days or weeks at a time. Chronic stress may cause an increase in heart rate and blood pressure.

- Not all stress is bad. Speaking to a group or watching a close football game can be stressful, but they can be fun, too. The key is to manage stress properly.

- Stress may affect behaviors and factors that increase heart disease risk: high blood pressure and cholesterol levels, smoking, physical inactivity and overeating.
Psychosocial Management

- “Quality of Life” perception questionnaire
- Assess for depression
- Support
  - Exercise room conversation provides support
  - Stress Management class
  - Connect with clinical psychologist
  - If already in treatment, communicate with that healthcare provider
    - Medication compliance
  - Support Groups
Physical Activity

- Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure.

- Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally.

The four main types of physical activity are:

**Aerobic** - Makes your heart rate and respiratory rate increase, making your heart and lungs stronger over time.
  - running, swimming, walking, biking, etc

**Muscle-strengthening** - Improves strength, power and endurance of muscles
  - Push-ups, sit-ups, weight lifting, stair climbing, etc

**Bone-strengthening** - with feet, legs or arms supporting body’s weight, the muscles are pushed against the bones
  - running, walking, lifting weights, etc

**Stretching** - helps improve flexibility and ability to fully move joints
  - Side stretches, yoga, etc
Physical Activity Counseling

- History of recent activity levels
- What are individual activity needs
  - Domestic
  - Occupational
  - Recreational
- We typically encourage gradual accumulation of 30-60 minutes a day, 5 times a week

- Education
  - Guidelines for safe, effective exercise
  - Exercise at home during program
  - Exercise after graduation from program
Exercise Training

- Exercise is a type of physical activity that's planned and structured.
- Medically supervised, telemetry monitored, exercise program
- Individualized exercise prescription
  - Frequency
  - Intensity
  - Time
  - Type
  - Volume
  - Progression
- Warm up, Cooldown, Strength Training and Flexibility
Benefits of Exercise

- Improves blood circulation, which reduces the risk of heart disease
- Establishes good heart-healthy habits in children and counters the conditions (obesity, high blood pressure, poor cholesterol levels, poor lifestyle habits, etc.) that lead to heart attack and stroke later in life
- Reduces risk of developing CHD/CVD by 30-40 percent
- Reduced risk of stroke by 20 percent in moderately active people and by 27 percent in those who are highly active
- Improves blood cholesterol levels
- Prevents and manages high blood pressure
- Prevents bone loss
- Keeps weight under control
- Boosts energy level
- Helps manage stress
- Counters anxiety and depression
- Helps you fall asleep faster and sleep more soundly
- Increases muscle strength, increasing the ability to do other physical activities
Case Study:

66 yo black female

PMH:
Coronary stent-12 years PTA
HTN
ESRD
Sleep Apnea
Breast Ca
Hyperparathyroidism of renal failure
Vitamin D deficiency of renal failure
Gout

Event:
Patient was receiving hemodialysis for ESRD for approximately one year.
On renal transplant list, when 2 weeks PTA, she began experiencing chest tightness while being dialyzed.
Symptoms prompted Cardiac Cath which revealed TVD.
Patient had CABG x 3 with LIMA.
Post-op course complicated with cardiac arrest in the OR and in the unit.
Hospital readmission for Afib with RVR.
## Case Study:

### Clinical Outcomes:

<table>
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<th>Measure</th>
<th>Pre-Entry</th>
<th>Post-Entry</th>
<th>Goals</th>
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<tbody>
<tr>
<td><strong>Resting B/P:</strong></td>
<td>154/70</td>
<td>120/62</td>
<td></td>
</tr>
<tr>
<td>6MWT (ft):</td>
<td>150</td>
<td>1050</td>
<td></td>
</tr>
<tr>
<td>METS from 6MWT:</td>
<td>1.22</td>
<td>2.52</td>
<td></td>
</tr>
<tr>
<td><strong>Lipids:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC:</td>
<td>168</td>
<td>179</td>
<td>(5-10% loss)</td>
</tr>
<tr>
<td>HDL:</td>
<td>33</td>
<td>51</td>
<td>(&lt;25)</td>
</tr>
<tr>
<td>LDL:</td>
<td>109</td>
<td>108</td>
<td>(&lt;35 F &lt;40m)</td>
</tr>
<tr>
<td>TG:</td>
<td>129</td>
<td>102</td>
<td>(worst=45,</td>
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<tr>
<td><strong>Weight-lbs:</strong></td>
<td>160</td>
<td>147</td>
<td>(goal is &lt;5)</td>
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<tr>
<td><strong>Ht: 70 inches BMI:</strong></td>
<td>22.9</td>
<td>21.03</td>
<td>(&lt;25)</td>
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<tr>
<td><strong>Waist-inches:</strong></td>
<td>36</td>
<td>33</td>
<td>(&lt;35 F &lt;40m)</td>
</tr>
<tr>
<td><strong>Psychosocial:</strong></td>
<td>29</td>
<td>18</td>
<td>(worst=45,</td>
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<tr>
<td>lower=improved)</td>
<td></td>
<td></td>
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<tr>
<td><strong>PHQ9:</strong></td>
<td>20</td>
<td>6</td>
<td>(goal is &lt;5)</td>
</tr>
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### Behavior Outcomes:

<table>
<thead>
<tr>
<th>Measure</th>
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<th>Post-Entry</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smoking:</strong></td>
<td>0</td>
<td>0</td>
<td>(worst=23</td>
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<tr>
<td><strong>Dietary-Rate your Plate:</strong></td>
<td>43</td>
<td>56</td>
<td>(350-500)</td>
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<tr>
<td>good+=&gt;55)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Activity-Met/ Min/Week:</strong></td>
<td>0</td>
<td>500</td>
<td>(350-500)</td>
</tr>
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</table>
**Summary:**

- CR & SP is a program that looks at the entire patient, as a unique individual, to create a program that will promote increased physical abilities, quality of life, independence and confidence.

- CR & SP provides education and counseling by a diverse Healthcare population, with specific expertise, to ensure that the patient is aware of his/her risk factors and is provided with the tools to manage these risk factors.

- It is the role of CR & SP to empowered patients to understand and manage their disease in the earliest stage, to stop the progression of disease.

- Age should not be a barrier to participation. Both the younger and older population should be afforded the opportunity to receive the tools to manage their disease, return to a productive and satisfying life, limiting co-morbidity issues and impairment of life expectancy.