10:30 am–12:15 pm
Scientific Free Communication
Session A -1

New Investigator Award Session

PRETENDING MAXIMAL HEART RATE THROUGH SUBMAXIMAL EXERCISE TESTS
Andrea L. Vävere, MS; Carl Foster, PhD; Glen Brice, PhD; Raymond Martinez, PhD; John P. Porcari, PhD, University of Wisconsin-La Crosse

Rationale: Maximal HR (HRmax) is critical for exercise prescription. HRmax is usually predicted using age-based equations, 220-age being the most common. The accuracy of 220-age is suspect, with SEE ~12 bpm. Even contemporary age-based equations (averaging 210-0.70*age) have SEE of 6–13. This inaccuracy can lead to significant errors in exercise prescription.

Objectives: This study was designed to test strategies for predicting HRmax based on the HR response during submaximal exercise.

Methodology: Healthy volunteers (age 22–53) (n = 28) performed maximal treadmill exercise to define HRmax. They also performed submaximal exercise tests based on Edwards’ Heart Zones approach. These submaximal tests were: 5-min Walk Test, 1-min Chair Test, 3-min Step Test, Talk Test, 2-min 10 Beat Test, 2 by 4-min Test, and Easy-Moderate-Hard Test. Each test had unique instructions and included a self-assessed fitness level to predict HRmax.

Results: There were significant (P < 0.05) differences between measured HRmax (189 ± 12) and predicted HRmax from: 2 × 4-min test (214 ± 13), Talk Test (199 ± 11), Step Test (202 ± 20), Walk Test (176 ± 22) and 2-min 10 Beat Test (214 ± 8). Linear regression demonstrated that predicted HRmax from all submaximal exercises was poorly related to HRmax (R² = 0.04 ± 0.56). If self-assessed fitness level was ignored, the highest HR during the submaximal tests was better in predicting HRmax (R² = 0.01 – 0.66). The best predictors of HRmax were HR at the last time speech was comfortable (R² = 0.26; SEE = 12), HR at RPE = 5 (Hard) (R² = 0.34; SEE = 9), and HR at the time speech became impossible (R² = 0.66; SEE = 7). Attempts to use the regression of RPE and HR during the incremental exercise test demonstrated that HR @ RPE of 5 (Hard) was best at predicting HRmax (R² = 0.21; SEE = 10).

Conclusion: HRmax is difficult to predict based on results of submaximal exercise tests. The gain in predictive accuracy over an optimized age prediction is not likely to be of practical significance.

THE PHYSIOLOGICAL EFFECTS OF 8 WEEKS OF YOGA TRAINING
Dawn D. Boede, MS; John P. Porcari, PhD; John Greany, MS, PT; Brian Udermann, PhD; Dana Johanson, BS; Carl Foster, PhD, University of Wisconsin-La Crosse

Rationale: Hatha yoga has been practiced for thousands of years and has become a popular form of exercise. Previous studies have focused on changes in ventilatory function and stress reduction consequent to yoga training. However, studies investigating the effects of yoga on muscular strength and endurance, flexibility, balance, and aerobic capacity are lacking.

Objectives: This study was designed to investigate changes in VO₂max, ventilation, maximal heart rate, muscular strength and endurance, flexibility, and balance after 8 weeks of thrice-weekly (50 min per session) yoga training.

Methodology: Healthy volunteers (age 20-55) (n = 34) were randomly divided into an experimental group (yoga) and a control group (no exercise). Both groups were tested before and after the 8-week training period. The tests assessed VO₂max, maximal heart rate, MVC, FEV₁, muscular strength and endurance, flexibility, and balance.

Results: The experimental group had significant (P < 0.05) improvements in trunk flexion (7°), trunk extension (8°), trunk rotation to the right (22°) and left (19°), ankle range of motion (6°), sit and reach (3 in), back scratch to the right (1.2 in) and left (1.2 in), shoulder elevation (1.6 in), trunk lift (1.9 in), push-ups (6), curl-ups (14), and one-leg stand (17 sec) compared to the control group. There were no significant improvements in maximal heart rate, VO₂max, MVC, FVC, FEV₁, or functional reach as a result of training.

Conclusion: When practiced regularly, Hatha yoga can significantly improve muscular strength and endurance, flexibility, and balance. However, the metabolic intensity of Hatha yoga does not appear to be sufficient to improve cardiorespiratory measures.

COMPARISON OF BRUCE AND MODIFIED BRUCE TREADMILL PROTOCOLS
Matthew J. Faber, PhD; Carl Foster, PhD; John Greany, PT, MS; Glenn Wright, PhD; Brian K. Allen, MD; John P. Porcari, PhD, University of Wisconsin-La Crosse

Rationale: The Bruce treadmill protocol (BR) is the most widely used clinical exercise protocol. However, the high starting workload and large changes between stages make BR less than optimal for older & more debilitated patients. Despite this limitation, physicians are widely familiar with BR, and it is still widely used. Several modifications (M) of BR have been developed, but none maintain the net rate of workload incrementation, which is critical for physician acceptance, while starting lower and having smaller differences between stages.

Objective: This study was designed to compare exercise responses to BR & MBR, to test the hypothesis that MBR would be physiologically equivalent to BR, but have better patient acceptance.

Methodology: Volunteer subjects (age 21–72) (n = 22) performed a habitation treadmill test and then randomly ordered BR & MBR, all with concurrent measurement of respiratory gas exchange. The starting point of MBR was lower (1.4 mph, 0% grade), and the workload changed every minute, but the speed & grade were equivalent to HR during every 3rd min.

Results: Exercise responses were generally of similar magnitude and well related between MBR vs BR. Treadmill time was longer for MBR (P < .05) (10.2 ± 2.9 vs 9.5 ± 2.8 min; R² = 0.94), however there were no differences in VO₂max (295 ± 9 vs 303 ± 10 mL/kg; R² = 0.95), HRmax (169 ± 27 vs 172 ± 29 bpm; R² = 0.87), RPP (29.4 ± 5.6 vs 28.9 ± 6.9 *10³; R² = 0.77), V̇O₂max (83 ± 29 vs 88 ± 31 L/min; R² = 0.91). Most (20 of 22; 91%) of the subjects preferred MBR.

Conclusion: The MBR allows provocation of similar physiologic responses, with only a minimally different time requirement, and a strong subject preference. As such it may provide a convenient alternative to BR, with comparable physician acceptance and better patient tolerability.


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IS ADHERENCE TO CARDIAC REHABILITATION RELATED TO IMPROVEMENTS IN EXERCISE CAPACITY AND HEALTH RELATED QUALITY OF LIFE?
Jeffrey L. Alexander, PhD; Carolyn L. Wagner, RN, Banner Baywood Heart Hospital

Rationale: Despite the known benefits of cardiac rehabilitation (CR) many patients fail to adhere to CR. Regardless of the reasons for a lack of adherence, it remains unclear what the short (3-month) and long (1-year) term benefit of CR attendance is for patients at varying levels of adherence.

Objective: The purpose of this study was to determine the relationship between adherence to CR and achieved benefits as measured by Health Related Quality of Life (HRQL) and exercise capacity (ExCp) to a 12-week, Phase II CR program.

Methodology: Previously collected data from 153 CR patients (114 males, 39 females; 69.1 ± 11.5 yrs) was utilized to complete this retrospective study. Patients had completed the Medical Outcomes Survey Short Form-36 (SF36) to assess HRQL at the beginning of CR (N = 153) and at 3-months (N = 152) and 1-year (N = 94). ExCp was determined by the patients’ maximum MET level achieved in their last session of CR. Pearson correlation coefficients were generated to assess the relationship between CR attendance and improvements in HRQL as well as ending ExCp. Paired sample t-tests were completed to determine the effect of CR on HRQL at 3-months and 1-year for the entire sample.

Results: Average attendance was 19 out of 36 sessions (54% adherence rate). Pearson correlation coefficients showed no relationship between CR adherence and improvements in HRQL (r = 0.0003 to 0.11) and a moderate relationship (r = 0.52) between adherence and ExCp. Significant improvements in HRQL were found among all patients regardless of adherence rate from baseline to 3-months with improvements remaining significant at 1-year.

Conclusions: Study findings demonstrate the effectiveness of CR in improving patient HRQL short- and long-term regardless of patient adherence rate. However, these findings suggest ExCp achieved in CR is related to patient adherence.

ADHERENCE TO A MULTICOMPONENT LIFESTYLE MODIFICATION PROGRAM
Michael D. Sumner, PhD; Gerdi Weidner, PhD; Terri Merritt-Worden, MS; Joli Studley, MS; Dean Ornish, MD; Preventive Medicine Research Institute; Highmark, Inc

Introduction: Evidence suggests that comprehensive lifestyle changes benefit coronary patients. However, long-term adherence to multicomponent lifestyle programs has not been sufficiently demonstrated.

Method: We assessed adherence to the 4 components of an ongoing lifestyle modification program (diet, exercise, stress management, group support) at baseline, 3, and 12 months into the program. To date, 1679 participants (mean age 58 ± 9; 50% female) with coronary heart disease (CHD; 51%) or elevated risk factors (e.g. diabetes, hypertension) have completed the 3-month follow-up, and preliminary data have been collected on 878 participants who have currently reached 1 year.

Results: All results were significant at P < .001. Analyses indicated that patients were able to meet program guidelines at 3 months and maintained high levels of adherence at 1 year (see table). Further analyses indicate that over 74% of participants were able to meet or exceed 4 out of 6 program benchmarks at both 3 months and 1 year. Results by gender indicate similar results for both men and women. Results by cardiac diagnosis indicate that those with CHD entered the program with higher dietary and exercise adherence, though all participants, regardless of disease severity, evidenced similar levels of adherence.

Conclusions: These results demonstrate that women and men with CHD and/or elevated risk factors can make and maintain comprehensive changes in diet and lifestyle over a 1-year follow-up period.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline</th>
<th>3 Months</th>
<th>1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary Fat (% of total calories)</td>
<td>27</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Dietary Cholesterol (mg)</td>
<td>198</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Fiber (grams)</td>
<td>24</td>
<td>41</td>
<td>39</td>
</tr>
<tr>
<td>Exercise (minutes per week)</td>
<td>88</td>
<td>225</td>
<td>197</td>
</tr>
<tr>
<td>Stress Management (minutes per week)</td>
<td>25</td>
<td>366</td>
<td>248</td>
</tr>
<tr>
<td>Attendance at Group Support Meetings (%)</td>
<td>–</td>
<td>93</td>
<td>89</td>
</tr>
</tbody>
</table>

CARDIOPULMONARY REHABILITATION AND DEPRESSION ASSESSMENT
Daniel V. Curnier, PhD; Evelyne Foucher, MSc; Cédric Marty, MSc; Zeev Maoz, PhD; Marc Bousquet, MD; Claude Authier, MD; Laurent Soukari, MD; UKRSTAP, Paul Sabatier University; Le Mirail University; Cardiopulmonary Rehab Center

Rationale: Population with chronic condition exhibits a high prevalence of depression. Exercise train exercise may have an important impact in improving symptoms of depression. Several tools were developed for depression evaluation such as questionnaires.

Objective: The aim of this work was to specify the most sensitive depression scale for cardiopulmonary rehabilitation.

Methodology: 74 cardiopulmonary patients followed a four-week exercise training program in a cardiac rehabilitation center. Depression was assessed using the Beck Depression Inventory (Beck), the Geriatric Depression Scale (GDS), the Center for Epidemiologic Studies Depression scale (CES-D) and the Hospital Anxiety and Depression scale (HAD). The patients filled out the 4 questionnaires and underwent an incremental exercise test before and after training. We dichotomized the groups by physical capacity level and physical improvement.

Results: All the depression tests showed an improvement of the score after exercise training whatever the type of pathology, deconditioning or improvement after exercise training. The results were significant for the Beck, CES-D and HAD for all situations. The GDS was significant only in 1 situation for pulmonary patients. When we dichotomized the deconditioning coefficient, the Beck (P = .0007 vs P = .0637) and the HAD (P = .0337 vs P = .034) showed inverse impact of the deconditioning on the depression after exercise training. When we dichotomized the physical improvement, the Beck was the most sensitive (P < .0001) for the patients who had the less exercise capacity improvement as compared to patients with larger improvement (P = .0637). The CES-D seems the most sensitive depression questionnaire for cardiopulmonary rehabilitation use.

Conclusion: Conflicting results were found depending on the questionnaire. The improvements evaluated with one or another questionnaire is extremely variable, and pathology, physical capacity or improvement had a major impact on the results. Tools such as questionnaire used to evaluate depression modifications can not replace a clinician like a psychologist in an individual health evaluation.
VALIDITY AND RELIABILITY OF THE NORTH CAROLINA 6-MINUTE CYCLE TEST

David Verrill, MS, RCEP, Lauren Fox, MA; Joe Miller, BS, RCEP; Claire Belles, MS; Jera Barrier, MS; Mike Lippard, MA, NorthEast Medical Center Health and Fitness Institute, Concord, NC

**Rationale:** The six-minute cycle (6MC) test is a commonly used assessment of physical performance in North Carolina cardiac rehabilitation (CR) participants. This test was designed as an alternative for CR facilities with limitations that did not allow for appropriate administration of the six-minute walk (6MW) test. However, to date this test has not been analyzed for reliability or for validity when compared to a maximal graded exercise (MGX) test.

**Objective:** To investigate the relationships between 6MC tests performed over 3 time periods and how these tests compared to 6MW and MGX tests in entry-level CR participants.

**Methodology:** Eighty men and 21 women (N = 101) with cardiovascular disease aged 42–79 years who entered the CR program at NorthEast Medical Center performed 6MC tests on a Schwinn AirDyne™ cycle ergometer at the same time of day for 3 consecutive visits to the center within the first week of CR participation. Distance pedaled was calculated to the nearest 1/100 of a mile and converted to feet. These same participants performed a 6MW test on their first CR visit and a MGX test using a Modified Bruce protocol prior to their first CR visit. Treadmill performance was measured by time and then converted to maximal metabolic equivalents (MET) values using ACSM prediction equations. Resting and peak exercise heart rate, blood pressure, and Borg rating of perceived exertion (6–20 scale) were also measured during each test.

**Results:** Pearson correlation coefficients ranged from 0.78 to 0.89 for the three 6MC tests, showing good test-retest reliability. Correlations between the 6MC, 6MW, and MGX tests are shown below:

<table>
<thead>
<tr>
<th>Performance Test</th>
<th>6MW Test</th>
<th>MGX Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MC Test 1</td>
<td>0.59**</td>
<td>0.51**</td>
</tr>
<tr>
<td>6MC Test 2</td>
<td>0.59**</td>
<td>0.56**</td>
</tr>
<tr>
<td>6MC Test 3</td>
<td>0.55**</td>
<td>0.63**</td>
</tr>
<tr>
<td>6MW Test</td>
<td>1.00**</td>
<td>0.67**</td>
</tr>
</tbody>
</table>

**Conclusions:** The 6MC trial and 6MW test showed the greatest relationship to the MGX test, indicating that a 6MC testing effect may have been evident. Based on this patient cohort, the 6MC test appears to be both a reliable and valid measure of functional capacity in CR entry participants.

CHARACTERISTICS OF CARDIOPULMONARY EXERCISE TESTING IN HEART FAILURE: COMPARING AMERICAN AND EUROPEAN MODELS

Ross Arena, PhD, PT,1 Marco Guazzi, MD, PhD,2 Mary Ann Peberdy, MD,1 Virginia Commonwealth University; 2University of Milano, San Paolo Hospital

**Rationale:** Cardiopulmonary exercise testing (CPET) in the heart failure (HF) population is a standard of care in both American and European clinics although the mode of exercise typically differs.

**Objectives:** The purpose of the present study was to compare the prognostic characteristics of peak oxygen consumption (Vo2) and the minute ventilation-carbon dioxide production (VE/VCO2) slope between two independent (American vs. European) HF groups.

**Methodology:** One hundred and thirty-seven subjects underwent LE ergometry CPET at San Paolo Hospital in Milano, Italy (SPH). One hundred and six subjects underwent treadmill CPET at Virginia Commonwealth University in Richmond, Virginia (VCU).

**Results:** Unpaired t-test results are reported SPH vs. VCU group throughout. Age (59.0 ± 10.6 vs. 49.7 ± 14.2), peak VO2 (16.4 ± 4.5 vs. 14.8 ± 5.2 mlO2/kg -1min -1) and ejection fraction (33.8 ± 11.3 vs. 27.7 ± 13.1%) were significantly greater in the SPH group (P < .01). VE/VCO2 slope (34.2 ± 8.2 vs. 35.3 ± 8.5) was similar between both groups (P > .05). There were 14 cardiac-related deaths over the one-year tracking period in both groups. ROC curve areas for peak VO2 were 0.78: SPH and 0.71: VCU (P < .01). Optimal prognostic threshold values for peak VO2 were 13.0 mlO2/kg -1min -1 (sensitivity: 62%, specificity 86%) in the SPH group and 12.1 mlO2/kg -1min -1 (sensitivity: 74%, specificity 64%) in the VCU group. ROC curve areas for VE/VCO2 slope were 0.82: SPH and 0.81: VCU (P < .001). The optimal prognostic threshold value for VE/VCO2 slope was 34.5 in both the SPH (sensitivity: 62%, specificity 86%) and VCU (sensitivity: 64%, specificity 86%) groups.

**Conclusions:** Despite differences in mode of exercise, baseline and CPET characteristics and mortality rate, the prognostic characteristics of peak VO2 and VE/VCO2 slope were similar between the two centers. These results suggest that neither the mode of exercise or differences in subject characteristics between different centers negatively impact the prognostic utility of CPET responses in HF.

EFFECTS OF A MAXIMAL GRADED EXERCISE TEST ON GLUTATHIONE (GSH) AS A MARKER OF ACUTE OXIDATIVE STRESS IN SUBJECTS WITH CAD

Ahmed Samir Elokda, PT, CLT-LANA, PhD, NYIT

**Rationale:** Strenuous exercise in animal studies has been shown to cause acute oxidative stress due to the generation of oxygen-centered free radicals reflected in lower levels of Glutathione (GSH), higher levels of Glutathione Disulfide (GSSG), and a drop in GSH:GSSG ratios, the maintenance of which is crucial for a variety of cell functions. Human studies on this topic are limited, and in subjects with CAD are lacking.

**Purpose:** The purpose of this study was to verify the validity of using a maximal treadmill GXT (Modified Bruce Protocol) as a model to induce acute oxidative stress, with full recovery at 60 minutes post exercise in subjects with CAD.

**Methodology:** Twenty subjects with CAD (10 males, and 10 females; age = 63.1 ± 4.7, weight = 89.4 ± 7 Kg, and height = 174.9 ± 12 cm, max Vo2 = 26.2 ml·kg -1·min -1) were used as a sample of convenience. Venous blood samples for GSH, and GSSG were collected directly before, immediately after, and 60 minutes post max GXT. A 2 factor mixed model repeated measures ANOVA was used for data analysis.

**Results:** As an acute response to maximal exercise, the GSH levels dropped significantly from a resting baseline value of 1002 μM to an immediate post max GXT value of 780 μM. The GSSG levels significantly increased from 2.6 μM to 3.4 μM. The GSH:GSSG ratio levels significantly dropped from baseline 385 to 229 post exercise. The blood GSH, GSSG, and GSH:GSSG ratios levels showed no significant difference at 60 minutes post max GXT when compared to resting values, indicating full recovery.

**Conclusion:** The current data indicated that in subjects with CAD a maximal treadmill GXT is a valid model for inducing acute oxidative stress, with full return to resting baseline levels within 60 minutes of recovery. The potential for using this model as an acute oxidative stress responses to cardiac and pulmonary rehabilitation is of clinical interest with a need for further investigation.
A COMPARISON OF COMORBIDITY INDEXES AND THEIR CLASSIFICATION OF PATIENTS WITH CORONARY ARTERY DISEASE ENROLLED IN CARDIAC REHABILITATION
Bonnie Sanderson, PhD, RN; Gilbert Zoghbi, MD; Vera Bittner, MD, MSPH, 1 University of Alabama at Birmingham

Rationale and Objective: Comorbid conditions in patients with coronary artery disease (CAD) affect clinical outcomes. Assessment of comorbidities is important for risk stratification and outcome evaluation. Weighted Comorbidity Indexes (CMIs) have been developed to help quantify the burden of comorbid conditions, including one in a CR population (CMI-CR) and another among patients undergoing cardiac catheterization (CMI-CAD). We compared the characteristics of the two CMIs within our CR population.

Methodology: Data from patients enrolled in our CR program between 1/96-12/04 were examined to compare the two CMI scoring protocols and resulting patient classification.

Results: Patients with CAD (n = 901) included 33% women, 33% non-white, average age was 60 (±11) years. AACVPR risk stratification included 44% high, 36% intermediate, and 20% low risk. Risk factors were prevalent: 85% dyslipidemia, 77% hypertension, 36% diabetes 50% obese, 69% with low physical activity and 20% smoking. Mean CMI-CR was 1.6 (±1.6) with a range of 0-8. Mean CMI-CAD was 2.8 (±2.2) with a range of 0-14. The CMI’s were significantly correlated (r = 0.54, P < 0.01) but the distribution of patients within the score rankings varied between the CMIs, primarily due to different weighting of renal disease. The table illustrates the range of CMI-CAD scores that classified patients within each CMI-CR score.

<table>
<thead>
<tr>
<th>CMI-CR</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMI-CAD</td>
<td>0.2</td>
<td>1.1</td>
<td>1.0</td>
<td>1.1</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.1</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Conclusion: Although the CAD-specific CMIs were significantly correlated in this CR population, different patient groups were identified as having high co-morbidity burden in large part related to the differential weighting of renal disease. Future studies need to evaluate and compare the prognostic utility of the two indexes for short-term (during CR) and long-term (after CR) outcomes in CR populations.

EVALUATION OF Pedometer STEPS IN PATIENTS WITH DIASTOLIC AND SYSTOLIC HEART FAILURE
Sue Abelt, MS; 1 Carrie Ritchie, PhD; 1 Neil Smart, MSc, 1 Jean Emerson, MS; 2 Maryl Johnson, MD; 2 Gabrielle Appleton, MAppSc; 3 University of Queensland; 3 University of Wisconsin

Background: Recommended daily step volume and subsequent step increments are beginning to emerge for healthy populations. These recommendations are used to provide tangible goals for increasing activity. The simplicity of this type of activity prescription may be attractive for individuals with heart failure (HF). To date, however, recommendations for walking-related activity are unknown for individuals with HF. The aim of the present study was to assess the efficacy of the pedometer as a measurement tool in patients with systolic heart failure (CHF) and diastolic heart failure (DHF).

Methods: Twelve individuals with CHF (mean ejection fraction (EF) = 30.7% ± 12.8) and 15 individuals with DHF (mean EF = 55.5% ± 9.1) completed the following: a maximal oxygen uptake test (peak VO2, pedometer step measurements for seven days; and a self-report physical activity (PA) and sit-time history.

Results: Pearson product moment correlation showed average daily steps was significantly correlated with VO2 peak (r = 0.84, P < 0.0001), even when adjusted for age. Women were slightly older than men (62 ± 3.4 vs 14.8 ± 4.1 mL/kg * min -1, P < 0.0001). Patients undergoing coronary bypass surgery had a significantly lower peak VO2 than non-surgical patients (post-myocardial infarction, percutaneous revascularization and chronic angina) for both females (13.6 ± 3.4 vs 14.8 ± 4.1 mL/kg * min -1, P < 0.0001) and males (17.9 ± 4.8 vs 20.3 ± 6.7 mL/kg * min -1, P < 0.0001). Patients with diabetes had significantly lower peak VO2 than non-diabetic patients (F = 16.8, P < 0.0001). VO2 peak (F = 3.8, P < 0.033), and average daily pedometer steps (F = 5.8, P = 0.020). The average daily steps for DHF (8179 ± 3585) was similar to apparently healthy populations (approximate mean = 7000 steps), while the mean daily steps for the CHF group (4973.4 ± 470.9) was substantially lower.

Conclusion: This data suggests that individuals with DHF may be able to safely follow guidelines for apparently healthy populations. Optimal step progressions for patients with HF are likely to be less. In conclusion, the results of this study indicate that measurement of baseline step counts may provide an indication of exercise capacity as patients with DHF and CHF.

PEAK AEROBIC CAPACITY ENTERING CARDIAC REHABILITATION: NORMATIVE VALUES
Patrick D. Savage, MS; Keteyian SJ; Brawner CA; 2 Ehrman JK; Lyons C; 1 Bunn J; 1 Aides PA; 1 Cardiac Rehabilitation, University of Vermont and Fletcher Allen Health Care, Burlington, VT; Preventive Cardiology, Henry Ford Hospital, Detroit, MI

Rationale: The measurement of peak aerobic exercise capacity is an important prognostic factor in patients with coronary heart disease and is central to developing an exercise prescription.

Objective: While normative values for peak VO2 in healthy individuals are well known, similar measures are not available for patients with coronary heart disease. The objective of this study is to report aerobic exercise capacity in a diverse population entering into cardiac rehabilitation (CR).

Methodology: Between 1996 and 2004, peak VO2 was measured in 2896 patients entering into CR in Burlington, VT (1902) and Detroit, MI (1394). Peak VO2 was assessed continuously during a symptom limited graded treadmill exercise tolerance test. Cardiopulmonary measures were averaged every 20 seconds and the highest value was termed peak VO2 expressed in relative (mL/kg * min -1) and absolute (L/min) terms.

Results: Overall, age of subjects was similar between centers (61 ± 11 years, range = 21 to 100 years). The Detroit center had more women (53.3 % vs 22.4 %, P < 0.001) and more minorities (59 % vs 1 %, P < 0.001) than Vermont. Mean peak VO2 for the entire cohort was 17.9 ± 6.0 mL/kg * min -1 and mean peak respiratory quotient was 1.09 ± 0.12. Relative and absolute peak VO2 were significantly lower in women compared to men (14.4 ± 3.9 mL/kg * min -1 vs 19.3 ± 6.1 mL/kg * min -1 and 1.13 ± 0.36 and 1.74 ± 0.61 L/min, respectively) (P < 0.001), even when adjusted for age. Women were slightly older than men (62 ± 11 vs 60 ± 11 years, respectively, P < 0.0001). Patients undergoing coronary bypass surgery had a significantly lower peak VO2 than non-surgical patients (post-myocardial infarction, percutaneous revascularization and chronic angina) for both females (13.6 ± 3.4 vs 14.8 ± 4.1 mL/kg * min -1, P < 0.0001) and males (17.9 ± 4.8 vs 20.3 ± 6.7 mL/kg * min -1, P < 0.0001). Conclusions: These results demonstrate that peak VO2 at entry into CR is remarkably low, particularly in women and post surgical patients. Given the negative prognostic implications of a low peak VO2, these results reinforce the importance of CR exercise training.

PHYSIOLOGIC COMPARISONS OF THE NORTH CAROLINA 6-MINUTE CYCLE TEST AND THE 6-MINUTE WALK TEST IN PATIENTS WITH CARDIOVASCULAR DISEASE
David Verrill, MS, RCEP; Brian Moore, MS; Lauren Fox, MA; Joe Miller, BS, RCEP; Claire Belles, MS; Jera Barrier, MS; Michael Lippard, MA, NorthEast Medical Center Health and Fitness Institute, Concord, NC and Wake Forest University/Baptist Medical Center, Winston-Salem, NC

Rationale: The North Carolina six-minute cycle (6MC) test was designed as an alternative measure of physical performance for cardiac rehabilitation (CR) facilities with limitations that did not allow for appropriate administration of the six-minute walk (6MW) test. Currently, little is known about how this self-paced test compares to the 6MW test from a physiologic perspective, or if gender differences exist between these tests in patients with cardiovascular disease.

Objective: To compare peak physiologic responses between the 6MC and 6MW tests in older men and women with cardiovascular disease who have recently entered a CR program.

Methodology: Eighty men and 21 women (mean age = 63.6 ± 6.7 years) performed 6MC tests on a Schwinn AirDyne® cycle ergometer at the same time of day for three consecutive visits within the first week of CR participation. Distance pedaled was calculated to the nearest 1/100 of a mile and converted to feet. These same participants also performed 6MW tests on their first CR visit. Resting and peak exercise heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), rate-pressure product (RPP), and Borg rating of perceived exertion (RPE) were measured during each test. Physiologic measures of the three 6MC tests were averaged and compared to the mean 6MW values.

Results: The men’s peak HR, SBP, RPP, and RPE responses were greater during the 6MC test than during the 6MW test. No differences were seen in peak HR, SBP, or RPP between tests in women. The women’s peak exercise RPE was higher in the 6MC test than in the 6MW test. No differences in DBP were seen between tests in either gender.

Conclusions: Staff of CR programs may expect higher cardiovascular responses when administering the 6MC test compared to the 6MW test in men, with similar responses noted between tests in women.

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EFFECT OF A COMPREHENSIVE CARDIAC REHABILITATION PROGRAM ON CARDIAC-RELATED EVENTS IN A FEMALE COHORT

Patrick Dunn, MS, MBA; Miguel Gambetta, MD; Ross Arena, PhD, PT
Heart Center, Community Hospital; Virginia Commonwealth University

Rationale: The body of evidence demonstrating the positive effect of cardiac rehabilitation (CR) is presently impressive and continues to expand. There are, however, numerous research questions in the area of CR requiring further investigation. As a result, most of the beneficial effect of CR has been demonstrated in predominantly male study groups.

Objectives: To assess the effect of CR on subsequent cardiac-related events in an all-female group.

Methodology: A total of 152 female subjects were included in this retrospective analysis. After suffering an initial cardiac-event requiring percutaneous transluminal coronary angioplasty with a drug-eluting stent, 76 of the subjects were enrolled in a comprehensive CR program. The cardiac rehab program lasted 12 weeks and included exercise training, education and case management of risk factors. The remaining 76 subjects only received standard care, which entailed routine follow up with their physician. All subjects were tracked for subsequent cardiac-related events for a mean duration of 21.9 (±10.8) months.

Results: Unpaired t-testing revealed the mean age between the CR and control group was not significantly different (69.6 (±10.6) vs. 72.0 (±10.4) years, P = .16). There were 9 and 29 subsequent cardiac-related events in the CR and control group respectively. In both groups, the primary subsequent event was an additional coronary revascularization procedure. Kaplan-Meier analysis revealed 88.3% of the CR group and 62.3% of the control group remained event-free during the tracking period. The difference in cardiac-related events between groups was statistically significant over the tracking period (Log-rank = 12.9, P < .001).

Conclusion: The results of the present study indicate participation in CR had a positive impact on reducing subsequent cardiac-related events in an all-female group. This finding is consistent with previous research conducted in predominately male cohorts. Future research should continue to be directed towards examining the effects of CR in females diagnosed with cardiovascular disease.

CARDIAC REHABILITATION OUTCOMES FOR OFF-PUMP VERSUS TRADITIONAL ON PUMP CORONARY BYPASS SURGERY

Adrian Aron, MS; Timothy R. McConnell, PhD; Troy A. Klinger, MS
1Bloomsburg University; 2Geisinger Medical Center

Rationale: Clinical evidence supports lower morbidity with off-pump coronary revascularization surgery as well as superior short- and mid-term outcomes, equivalent graft patency, and reduced cost. It has not been determined whether these advantages impact performance in cardiac rehabilitation.

Purpose: To compare cardiac rehabilitation outcomes between patients undergoing on-pump versus off-pump coronary artery bypass surgery.

Methods: Data was retrospectively examined for patients who participated in cardiac rehabilitation between 1996 and 2004. Two hundred ninety five patients who underwent bypass surgery and completed at least 80% of their 36 required sessions were divided into On-Pump and Off-Pump groups. Anthropometric characteristics included weight and abdominal and hip circumferences. Pre and post cardiac rehabilitation measures included: grip strength, flexibility, calories expended during class, quality of life, and self-efficacy.

Results: Both groups were similar with respect to age, sex, ejection fraction, length of stay, time from discharge to program start, and mean number of grafts. There were no statistical differences between the On-Pump and Off-Pump groups (P > .05) for weight, abdominal and hip circumferences, grip strength, flexibility, and total caloric expenditure. In addition, there were no between group (On-Pump versus Off-Pump) differences regarding quality of life (P = .20), and self-efficacy (P = .30). Grip strength (56.5 ± 11.2 vs. 58.5 ± 11.8, P < .01), flexibility (13.4 ± 12.5 vs. 16.8 ± 9.9, P < .01) and caloric expenditure during class (145.2 ± 66.5 vs. 281.4 ± 187.7, P < .01) improved with cardiac rehabilitation regardless of the surgical procedure. In addition, quality of life (4.4 ± 0.9 vs. 5.9 ± 0.8, P < .01) and self efficacy (49.1 ± 21.0 vs. 73.0 ± 21.4, P < .01) increased.

Conclusions: The present data support the concept that even though there are clinical advantages to off-pump surgery, there is no benefit over on-pump regarding cardiac rehabilitation. Subsequently, off-pump surgical patients should be managed similarly as their on-pump counterparts.
LIPID OUTCOMES IN CARDIOVASCULAR MAINTENANCE ONE YEAR AFTER COMPLETION OF CARDIAC REHABILITATION

Michelle La Londe, MA; Sophia Boudoulas-Meis, MD; Richard Snow, DO; Teresa Caulin-Glaser, MD

Rationale: Improvements in lipid profile is associated with a decrease risk of cardiovascular events. Maintenance of improvements achieved in cardiac rehabilitation (CR) is crucial to long term cardiovascular risk reduction.

Objectives: Describe and compare lipid changes achieved by participants in a CR program and to assess maintenance of lipid changes one year after completion of CR while participating in cardiovascular maintenance (CM) program.

Methodology: Retrospective analysis was designed to assess changes in lipids and the maintenance of these changes for participants completing CR and participating in a CM program. Analysis included participants participating in CM for a minimum of 6 months after completing CR with pre and post program lipid profile and for whom a lipid profile was measured 1 year ± 6 months after completion of CR while participating in CM. Between 1/1/01 and 12/31/03, 144 individuals met these criteria. Pre and post program for one year lipid profiles were compared using paired t-tests.

Results: The 144 participants had statistically significant improvements in low density lipoprotein (LDL), high density lipoprotein (HDL), and triglycerides (TG) levels. Total cholesterol (TC) also declined but the decrease was not statistically significant. There was a statistically significant increase in HDL in those with no significant changes in TG, LDL or TG between post CR lipids and first year CM lipids.

Conclusion: Statistically significant changes associated with CR were maintained in patients participating in CM for TC, LDL and TG. LDL levels increased significantly in the CM program in addition to a significant increase during CR.

COMPARISON OF HEALTH STATUS AS ASSESSED BY SF-36 HEALTH SURVEY (SF36) FOR ELDERLY PARTICIPANTS AND YOUNGER PARTICIPANTS IN A CARDIAC REHABILITATION (CR) PROGRAM.

Michelle La Londe, MA; Sophia Boudoulas Meis, DO; Richard Snow, DO; Lisa Hindman, RN, BSN; Shauna Miller, BS, MA; Jennifer Taylor, BSN, RNC; Teresa Caulin-Glaser, MD

Rationale: One goal of CR is to improve quality of life in participants. It is unclear if quality of life endpoints are achieved equally in CR by older and younger participants.

Objectives: Compare SF-36 scores pre and post CR for participants ≥70yrs versus those <70yrs of age.

Methodology: Retrospective analysis of 258 participants in CR between 2/5/04 and 3/4/05. Eighty-seven were ≥70yrs (77.3 ± 8.3 yrs), 171 <70yrs (57.3 ± 8.3 yrs). Participants had complete entry and exit data including SF36. Paired t-tests and Student t-tests were used for analysis.

Results: Higher SF36 scores indicate less dysfunction. Upon CR entry, elderly participants scored significantly higher in bodily pain and mental health domains, but significantly lower in the physical function than younger participants. At the completion of CR, both groups had significant improvement in all domains of the SF36. Younger participants had significantly greater improvement in vitality and role physical than elderly participants (P ≤ 0.02).

Conclusion: Elderly and younger participants achieved significant improvements in comprehensive health status as represented by the SF36. The differences between the groups in the bodily pain domain of the SF36 upon program entry may be indicative of a difference in perception of pain and not the amount of actual pain experienced by the groups.

COMPREHENSIVE HEALTH STATUS OUTCOMES AS MEASURED BY SF-36 BETWEEN GENDERS IN AN ELDERLY CARDIAC REHAB POPULATION

Sophia Boudoulas Meis, DO, MPH; Michelle Lalonde, MA; Rick Snow, DO, MPH; Jennifer Taylor, RN; Teresa Caulin-Glaser, MD

Rationale: It is unclear if cardiac rehabilitation (CR) improves quality of life endpoints in males (♂) and females (♀)≥70yrs of age.

Methodology: Analysis of 53 ♂ (76.4 ± 4.8 yrs), 34 ♀ (78.6 ± 4.4 yrs) completing CR between 2/04-3/05 with pre and post SF-36 data. Higher SF-36 scores indicate less dysfunction. Student’s t test and the paired t test were used for analysis.

Results: Upon CR entry, ♂ had a statistically significant higher physical function score than ♀ however there were no other significant differences between genders. There was no significant difference in SF-36 scores between the genders pre, post CR. The males showed significant improvement for all domains of the SF-36, while females showed a significant improvement in all domains of SF-36 except bodily pain, role emotional, and mental health post CR.

Parameter | Gender | Entry (Mean ± SD) | Exit (Mean ± SD) | P-value
--- | --- | --- | --- | ---
Phys Function | ♂ | 62.6 ± 23.9 | 74.3 ± 21.4 | <0.0001
♀ | 50.6 ± 23.1 | 59.7 ± 21.9 | 0.006
Role Physical | ♂ | 48.7 ± 31.3 | 67.9 ± 24.9 | <0.0001
♀ | 49.0 ± 25.0 | 62.6 ± 22.6 | 0.001
Bodily Pain | ♂ | 68.3 ± 26.5 | 81.1 ± 23.6 | 0.001
♀ | 68.8 ± 23.2 | 74.7 ± 21.5 | 0.1
Gen Health | ♂ | 61.4 ± 16.3 | 66.2 ± 18.1 | 0.02
♀ | 61.3 ± 17.5 | 66.8 ± 17.9 | 0.02
Vitality | ♂ | 55.2 ± 20.6 | 65.2 ± 17.6 | 0.0002
♀ | 49.2 ± 22.5 | 57.0 ± 18.3 | 0.03
Social Function | ♂ | 72.3 ± 28.6 | 87.8 ± 19.3 | 0.0004
♀ | 71.9 ± 28.5 | 84.3 ± 18.7 | 0.006
Role Emotion | ♂ | 76.4 ± 27.6 | 87.1 ± 20.6 | 0.005
♀ | 80.2 ± 25.6 | 85.8 ± 20.1 | 0.2
Mental Health | ♂ | 79.5 ± 15.9 | 84.7 ± 10.8 | 0.02
♀ | 80.9 ± 13.7 | 84.6 ± 11.6 | 0.1

Conclusion: Participation in CR can improve quality of life in elderly ♂ and ♀ with heart disease.

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EFFECT OF PHASE II CARDIAC REHABILITATION ON DEPRESSION AND QUALITY OF LIFE
Patricia Lounsbury, RNC, BSN, ME; Joseph Cavanaugh, PhD; Ellen E.I. Gordon, MD, University of Iowa Health Care, CHAMPS, Iowa City, Iowa

Rationale: Depression increases following cardiac events. Most current literature focuses on the benefits of antidepressant treatment with little to no mention of the benefits of cardiac rehabilitation (CR). Since CR improves quality of life, we hypothesized that CR would positively impact patients with depression without pharmaceutical intervention with a shorter CR than reported previously.

Objective: To assess the impact of CR on patients exhibiting depression following a cardiac event.

Methods: Since August 2000, all (n = 324) patients (74% men) were administered the Nine-Symptom Checklist (9Sx) (brief form of PRIME-MD Patient Health Questionnaire) and SF-36 at commencement (T1) and completion of CR (T2). Scores ≥12 on the 9Sx correlated with possible major depressive syndrome/disorder; scores ≥6 suggested other depressive syndrome. Lower 9Sx scores indicated improvement. The SF-36 measured nine domains of quality of life; higher scores indicated improvement.

Results: For the total population, completion of CR resulted in a statistically significant lowering of mean 9Sx scores (T1 5.93 → T2 3.52; P < .0001). In the subset of patients scoring ≥6 on the 9Sx, CR also resulted in improved scores in both men and women (Men: T1 10.89 → T2 5.93; Women: T1 11.23 → T2 5.65). Mean scores in the patients scoring ≤6 decreased from T1 39% to T2 14% in patients scoring ≥12 values decreased from T1 41% to T2 14%.

In patients undergoing coronary artery bypass grafting (CABG), initial T1 scores were significantly higher compared with the non-CABG population (7.79 vs 6.10, P < .0014). CR resulted in similar improvements in T2 scores that did not differ from the non-CABG population (2.98 vs 3.55, NS).

For the SF-36, matched paired t-tests indicated all domains of the SF-36 improved significantly (P < .0001 for all).

Conclusions: Depressive symptoms decrease and quality of life increases in patients undergoing 4-6 weeks of CR without pharmaceutical intervention.

EXERCISE TRAINING FOR CARDIAC PATIENTS: RESULTS OF FRENCH MULTICENTER REGISTER OF COMPLICATIONS DURING CARDIAC REHABILITATION IN 2003
Bruno Pavy, Service de réadaptation Cardiaque, Centre Hospitalier, Machecoul, France

Rationale: At present, the occurrence of serious cardiovascular complications during exercise training of cardiac patients is not well known. Published data are old and patient management (whether medical, interventional or surgical) has substantially progressed since then.

Objectives and Methodology: In 2003, the Working Group « Functional Exploration and Cardiac Rehabilitation » of the French Society of Cardiologists sent questionnaires to 65 French rehabilitation centers in order to establish a prospective multicenter register of complications during rehabilitation. Any serious event occurring during or just after a supervised training session or an exercise stress test (≤1 hour) was notified if it needed prompt medical intervention such as resuscitation, intravenous therapy or immediate transfert.

Results: 25420 patients, with a mean age of 61.3 and including 78% of men, were involved. They accumulated 743,471 patient hours of exercise and 42,419 exercise stress tests. 8,079 patients underwent coronary artery bypass graft (CABG), 5,089 percutaneous transhuminal coronary angioplasty (PTCA), 3116 were other coronary patients, 4,350 underwent valvular surgery and 2,941 were other non-coronary patients. 14 centers reported 20 complications. 5 occurred during tests (1 cardiac arrest, 1 occlusion of stent) necessitating 3 PTCA. 15 complications occurred during training: 1 cardiac arrest due to complete atrioventricular block, 8 thoracic pain including 2 occlusions of stent, requiring 5 PTCA, 4 ventricular arrhythmias and 2 others.

Conclusion: Neither fatal complication nor defibrillation were reported. The average cardiac arrest rate is very low (1.3 per million patient hours of participation). No complication occurs after CABG, but recently implanted stents require special supervision, although the rate of occlusion of stent during exercise is very low (0.07%).

IMPROVEMENT IN FUNCTIONAL MEASUREMENTS WITH AN 8 WEEK OUTPATIENT PULMONARY REHABILITATION PROGRAM IN MEN AND WOMEN
Monica Blaich, MS, EdM; Sophia Boudoudas Meis, DO, MPH; Michelle Lalonde, MA; Lisa Hindman, RN, BSN; Teresa Caulin-Glaser, MD, McConnell Heart Health Center, Columbus, Ohio

Rationale: Chronic pulmonary disease is an important cause of disability and handicap. One goal of pulmonary rehab (PR) is to improve activity tolerance with exercise training.

Objective: Describe improvements in 6 minute walk distance, functional strength, and flexibility measurements in † and ‡ completing a PR program.

Methods: Retrospective analysis was designed to identify improvements in 6 minute walk distance, functional strength, and flexibility in participants completing PR. Eighty-one individuals (mean age 67.71 ± 10.75) completed PR between 1/03 and 1/05; 70 had complete pre and post data. PR consisted of 24 exercise sessions including cardiovascular exercise, strength training and flexibility training. Pre and post parameters measured included 6 minute walk distance (distance), functional strength measuring chair sit and stand in 30 seconds (trbd), and a bilateral flexibility test using seated sit and reach (flexr and flexl). The Student’s t-test was used to evaluate for between gender differences and the paired t test was used to identify significant changes between pre and post values within each gender.

Results:

<table>
<thead>
<tr>
<th>Distance (feet)</th>
<th>Stride</th>
<th>Flexr (inches)</th>
<th>Flexl (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>† Pre</td>
<td>1043.7</td>
<td>497.7</td>
<td>2.2</td>
</tr>
<tr>
<td>n = 33</td>
<td>n = 30</td>
<td>n = 30</td>
<td>n = 30</td>
</tr>
<tr>
<td>† Post</td>
<td>1219.9</td>
<td>441.7</td>
<td>0.3</td>
</tr>
<tr>
<td>n = 33</td>
<td>n = 30</td>
<td>n = 30</td>
<td>n = 30</td>
</tr>
<tr>
<td>† P-value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.0003</td>
</tr>
<tr>
<td>‡ Pre</td>
<td>1128.6</td>
<td>336.5</td>
<td>5.2</td>
</tr>
<tr>
<td>n = 48</td>
<td>n = 40</td>
<td>n = 40</td>
<td>n = 40</td>
</tr>
<tr>
<td>‡ Post</td>
<td>1324.4</td>
<td>322.7</td>
<td>2.7</td>
</tr>
<tr>
<td>n = 48</td>
<td>n = 40</td>
<td>n = 40</td>
<td>n = 40</td>
</tr>
<tr>
<td>‡ P-value</td>
<td>&lt;0.0001</td>
<td>0.0004</td>
<td>0.003</td>
</tr>
</tbody>
</table>

There were no difference in the above parameters between † and ‡ pre and post PR.

Conclusion: An 8 week outpatient PR program can result in significant improvements in distance walked, functional strength, and flexibility in both † and ‡.
WEIGHT LOSS AND WEIGHT LOSS MAINTENANCE IN OBESE AND NON-OBESE PARTICIPANTS IN CARDIOVASCULAR REHABILITATION AND MAINTENANCE

Lamont Yoder, MBA, RN, CCRN; Cheryl Graffagnino, RD, LD; Michelle La Londe, MA; Joann Schaumberg, MS, RD, LD; Lisa Hindman, RN, BSN; Jennifer Taylor, BSN, RNC; Richard Snow, DO; Teresa Caulin-Glaser, MD, McConnell Heart Health Center, Columbus, Ohio

Rationale: Weight loss is associated with improvement in cardiovascular risk factors and decreased risk of coronary events.

Objectives: Describe and compare weight loss achieved by obese (BMI ≥ 30) and non-obese (BMI < 30) participants in a cardiovascular rehabilitation (CR) program and assess maintenance of weight loss one year after completion of CR while participating in a cardiovascular maintenance (CM) program.

Methodology: Retrospective analysis was designed assessing weight loss and weight loss maintenance for obese and non-obese participants completing a CR and participating in CM. Analysis included participants participating in CM for a minimum of 6 months after completing CR with a pre and post-program body weight and for whom body weight was measured at 1 year ± 6 months after completion of the CR while participating in CM. Between 1/1/01 and 12/31/03, 97 individuals met these criteria. Pre and post program and 1 year body weights were compared using paired t-tests.

Results: Obese and non-obese participants achieved a significant reduction in body weight after completion of CR with obese participants losing significantly more weight than their non-obese counterparts (P < .001). One year after completion of CR, obese participants in the CM had experienced some weight re-gain but it was not significant. However, non-obese participants in CM maintained a significant weight gain at 1 year in excess of the initial loss achieved in CR.

<table>
<thead>
<tr>
<th>Weight Change Pre to Post CR (pounds)</th>
<th>Weight Change Post CR to 1-year CM (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese Participants (n = 47)</td>
<td>6.3 ± 8.1 (P &lt; .0001)</td>
</tr>
<tr>
<td>Non-Obese Participants (n = 50)</td>
<td>1.7 ± 5.4 (P = 0.03)</td>
</tr>
</tbody>
</table>

Conclusion: Obese participants achieved significant weight loss in a CR program and maintained that weight loss in a CM program. Non-obese individuals achieved modest but significant weight losses in CR but appear to follow population trends toward weight gain when participating in CM.

MULTI-CENTER STUDY OF RISK FACTOR STATUS ON ENTRY INTO CARDIOVASCULAR REHABILITATION: MALE VERSUS FEMALE PATIENTS

Adam deJong, MA;1 Barry A, Franklin, PhD, MT;1 Richard D. Salmon, DDS;2 Kevin S. Reid, MA;2 William E. Saxon, ASRT;2 George C. Faircloth, MA;2 Brenda S. Wright, PhD;2 Richard F. Leighton, MD;2 Neil Gordon, MD;2 William Beaumont Hospital, Royal Oak;2 INTERVENT Coordinating Center, Savannah, GA;2 St. Joseph’s/Candler Health System, Savannah, GA

Rationale: Contemporary cardiovascular rehabilitation (CR) programs provide comprehensive cardiovascular disease (CVD) risk reduction interventions aimed at the control of multiple risk factors. Guidelines are available on goals for each risk factor. However, no comprehensive gender-specific data are available on the percentage of participants who are not already at recommended goal risk factor levels on entry into a contemporary phase 2 CR program.

Objectives: In this multi-center study, we compared the percentage of participants not at goal for select risk factors in male versus female patients at entry into a phase 2 CR program.

Methodology: Subjects were 11,148 consecutive male (Group A; n = 7,725; age = 65 +/- 11 years) and female (Group B; n = 3,423; age = 66 +/- 12 years) patients who enrolled in a phase 2 CR program at 30 centers in the United States after May 16, 2001 (i.e., the publication date of the National Cholesterol Education Program Adult Treatment Panel III Guidelines). Risk factors were evaluated using standardized procedures.

<table>
<thead>
<tr>
<th>CVD Risk Factor</th>
<th>Goal (Based on National Clinical Guidelines)</th>
<th>% Not At Goal Group A</th>
<th>% Not At Goal Group B</th>
<th>P (Group A versus Group B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarette smoking</td>
<td>Smoker cessation</td>
<td>6.7</td>
<td>6.3</td>
<td>NS</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>&lt;120 mm Hg</td>
<td>57.8</td>
<td>64.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>&lt;80 mm Hg</td>
<td>29.4</td>
<td>26.0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>&lt;100 mg/dl</td>
<td>41.0</td>
<td>47.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>&gt;39 mg/dl</td>
<td>52.7</td>
<td>22.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>&lt;150 mg/dl</td>
<td>40.7</td>
<td>47.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>&lt;25 kg/m²</td>
<td>80.2</td>
<td>72.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>&lt;100 mg/dl</td>
<td>62.2</td>
<td>56.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sedentary lifestyle</td>
<td>&gt;149 min/wk</td>
<td>78.2</td>
<td>88.1</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Conclusion: These data indicate that multiple risk factors are often inadequately controlled at entry into a contemporary phase 2 CR program. Our findings further indicate that gender-specific differences exist for multiple risk factors. These data are relevant to CR programs when prioritizing, designing, and developing comprehensive risk reduction interventions.

ST-SEGMENT DEPRESSION IN POST CORONARY ARTERY BYPASS GRAFT PATIENTS DURING PHASE II CARDIAC REHABILITATION: INCIDENCE AND SEQUELAE

Darin Gylten, MA, CES, CSCS; Patricia Lounsbury, RNC, MEi, CCRN; Ellen E. I. Gordon, MD

Rationale: ST segment depression is seen in the post coronary artery bypass graft (CABG) patient during Phase II cardiac rehabilitation (CR), but its significance is unclear and there is a paucity of information about it in the literature. We hypothesized that ischemic ECG signs are not uncommon in this patient population, but unlike other populations in CR, a revision in medical management (RMM) as a result of the finding is not likely.

Objectives: To assess the presence of ischemic electrocardiographic (ECG) signs in post-CABG patients and to determine if RMM as a result of the finding is as common as it is with other patients.

Methods: From January 2000, RMM have been tracked on all patients in CR; to date 618 patients (71% male) are available for analysis. ECG ischemia is defined as ST segment depression of ≥ 1 mm 80 msec after the J-point with normal QRS complex. Eighty-six subjects were eliminated because of QRS abnormalities resulting in 532 subjects for analysis.

Results: Of the eligible subjects, 137 (25.75%) underwent CABG. Of those 17 (12.4%) showed ECG ischemia at least once during CR compared with 76 (19.2%) of all others. Additional testing or hospitalization with re-catheterization occurred for 2.5% and 4.1% respectively for the non-CABG patients and 0% and 2.2% respectively for the CABG patients.

Conclusions: During Phase II CR, ECG signs suggestive of ischemia occur in 12.4% of patients with CABG and 19.2% of all other patients. Additional testing or hospitalization with re-catheterization is rare for the patient who underwent CABG.
BENEFIT OF CARDIAC REHABILITATION FOR THE METABOLIC SYNDROME AND RELATED VARIABLES IN PATIENTS WITH COMORBID DIABETES MELLITUS

Lisa A. Marsh, MS, ATC; Rachael A. Frame, BA; William P. Marley, PhD, Marshall University Medical Center, Huntington, WV

Rationale: Identifying individuals with the metabolic syndrome provides opportunities to intervene in the management of shared disease pathways predisposing individuals to both cardiovascular disease (CVD) and diabetes.

Objective: To determine the effect of multifactorial CR on the metabolic syndrome and related clinical variables in cardiac patients with comorbid type 2 diabetes mellitus.

Methods: Twenty-eight [28] patients [22 men, 6 women] with a mean age of 66.2 ± 8.5 years served as the basis for this study. They were enrolled in the Diabetes Exercise Center and participated in the multifactorial Cardiac Rehabilitation Program (CRP) of the Marshall University Medical Center. Interventions included exercise, smoke cessation, nutritional counseling, and weekly educational sessions with a variety of topics related to diabetes management and care. Guest speakers were physicians, nurses, exercise physiologists, podiatrists, registered dietitians, pharmacists, physical therapists, and other health professionals. Social events (e.g., picnics, holiday luncheons) as well as fun competition events (e.g., Wellness Challenge), were also scheduled to enhance group camaraderie. Patients were screened and risk stratified prior to program entry with a medical profile that included a history, physical, multi-stage exercise test, pulmonary function test, lipid profile, CBC, HbA1c, anthropometric measures, and risk factor analysis. Selected measures were repeated at 12 weeks and on a pattern of care basis.

Results: Significant (P < .05) changes in the metabolic syndrome were observed for 8.5% of patients. Significant changes over 12 weeks for both groups, there were greater reductions in the metabolic syndrome for the CRP group (all P < .05). Similarly, there was consistently lower STO2 during TMT compared to CON (all P ≤ .05). On the contrary, there were similar, significant increases in BF following TMT for both groups. Although both groups had similar BF responses to TMT and SpO2, there were greater reductions in BF following TMT for COPD as compared to CON (all P < .05).

Conclusion: Participation in a multifactorial CRP improved outcomes for the metabolic syndrome profile and related clinical variables in cardiac patients with comorbid type 2 diabetes mellitus.

THE EFFECTS OF INCREMENTAL TREADMILL WALKING ON SKELETAL MUSCLE OXYGEN SATURATION IN INDIVIDUALS WITH COPD

Gregory Martel, PhD;1 Ryan Fleming, MPT;1 Timothy Garrison, DPT;1 Barak Kraus, DPT;1 Arthur Scsofield, MPT;1 Matthew Terrell, MPT;1 Jeanne Ruff, MS,2 1University of Maryland Eastern Shore; 2Peninsula Regional Medical Center

Rationale: Pulse oximetry is commonly used to monitor arterial oxygen saturation (SpO2) during exercise in individuals with COPD. However, many patients exhibit poor exercise tolerance despite normal SpO2. Thus, near-infrared spectroscopy (NIRS), which estimates skeletal muscle oxygen saturation (StO2), may be more advantageous than pulse oximetry for monitoring patients with COPD during exercise.

Objectives: To examine how an incremental treadmill walking test (TMT) effects SpO2, StO2, and calf blood flow (BF) in individuals with COPD (n = 6; 70 ± 4 yr) and healthy controls (CON; n = 20; 58 ± 6 yr).

Methodology: SpO2 and StO2 were assessed at rest, during, and after TMT. The TMT consisted of seven stages with a constant speed of 2.0 mph and 3.5% increase in grade every three minutes. Calf BF was assessed with venous occlusion plethysmography before and after TMT. Independent t-tests and ANOVA with repeated measures were utilized to analyze the data. Significance was set at P ≤ .05.

Results: There were no significant group differences at rest for StO2 or BF, but SpO2 was significantly higher in CON (97.3 ± 1.4 vs. 95.5 ± 1.9 %; P < .05). Although SpO2 stayed above 90% during TMT for both groups, there were greater reductions in SpO2 during the TMT for COPD as compared to CON (all P < .05). Similarly, there was consistently lower StO2 during TMT for COPD compared to CON (all P ≤ .05). Conversely, SpO2 remained within acceptable ranges, COPD had lower StO2 and walking times, indicating that skeletal muscle dysfunction limits exercise capacity in COPD. Thus, NIRS may be an effective device for monitoring those with COPD during aerobic exercise.

PEDOMETER ASSOCIATIONS WITH HEALTH MARKERS IN MODERATE TO HIGH RISK PATIENTS

Brian K. Shrawder, MS;1 Timothy R. McConnell, PhD;1 William Santamore, PhD;2 1Bloomsburg University; 2Temple University

Purpose: To determine whether the number of steps/day is related to heart risk in individuals participating in a longitudinal clinical trial investigating the reduction of heart risk via telemedicine.

Methods: Study participants included 28 males and 20 females with one or more treatable risk factors for cardiovascular disease: hypertension, hyperlipidemia, tobacco use, or type II diabetes. Data obtained during the participants initial and four month follow-up visit was retrospectively reviewed; weight, resting blood pressure, lipid profile, risk score and 6-min walk. Between the initial and four-month clinic visits, patients transmitted their blood pressure, heart rate and steps/day. Specific aims: To assess the relation ship between steps per day and heart health biomarkers and determine significant changes in risk biomarkers over the 4-month period.

Results: All reported r values and differences were significant at the P < .05 level. At study entry there were significant correlations between steps/day and systolic blood pressure (r = 0.36), cholesterol (r = 0.32), and 6-min walk (r = 0.47). At 4 months, step/day were correlated with 6 min walk (r = 0.51). In addition, there were nonsignificant trends for HDL (P < .07) and risk score (P < .07). Significant changes over the four months occurred for systolic blood pressure (148 ± 20 versus 140 ± 17) and cholesterol (198 ± 47 versus 190 ± 44). There were nonsignificant trends for improvements in diastolic blood pressure (80 ± 12 versus 76 ± 12; P < .06) and triglycerides (174 ± 107 versus 155 ± 88; P < .08).

Conclusions: Number of steps/day is related to heart risk biomarkers, particularly blood pressure, cholesterol, and 6-min walk. Therefore, pedometer quantification of walking is a good tool for tracking participant walking and subsequent health risk. In addition, telemedicine reduced health risk over four months of follow-up.

SPIRITUALITY AND RELIGIOSITY: INFLUENCE ON QUALITY OF LIFE AND CONFIDENCE IN THE PATIENT’S ABILITY TO PERFORM PHYSICAL TASKS AMONG SPOUSE CAREGIVERS FOLLOWING A FIRST-TIME CARDIAC EVENT

Joan F. Miller, RN, CRNP, PhD,1 Troy A. Klinger, MS; Timothy R. McConnell, PhD,1 Bloomsburg University

Rationale: Evidence suggests patients derive support from spirituality and religiosity following a cardiac event. Limited data are available on the influence of spirituality and religiosity on the experience of the spouse caregiver.

Objectives: To describe the relationship between strength of spirituality and religiosity and spouses’ perceptions of quality of life and confidence in the patient’s ability to perform physical tasks after a first-time cardiac event. To determine if relationships exist between spouses’ and patients’ reports of strength of spirituality and religiosity, quality of life, and confidence in the patient’s ability to perform physical tasks.

Methodology: A cohort sample of 44 patients and their spouses completed measures of spirituality, religiosity, religious coping, quality of life, and self-efficacy at the start and completion of a 12-week outpatient cardiac rehabilitation program. Pearson product-moment correlation coefficients were calculated to examine relationships among variables.

Results: Strength of spirituality and religiosity was not associated with quality of life for spouses. Religious coping ($P < .05$) was negatively associated with the spouse’s confidence in the patient’s ability to perform physical tasks at the start of rehabilitation. Quality of life for spouses and confidence in the patient’s ability to perform physical tasks were related to patients’ quality of life and ratings of physical self-efficacy. Strength of spirituality and religiosity for spouses was associated with strength of spirituality and religiosity for patients.

Conclusion: Factors, such as anxiety and uncertainty, may influence quality of life for spouses during early recovery. Spouses who were more anxious during early recovery may have turned to religion or spirituality for support. A synergistic relationship between spouses’ and patients’ strength of spirituality and religiosity and their perceptions of quality of life and confidence in the patient’s physical self-efficacy suggests that interventions to promote adaptation include both patient and spouse.

PHYSICAL ACTIVITY IN PEOPLE WITH A SPINAL CORD INJURY

Jolene A. Butler, MS,1 Terrya Miller, IBS; Eileen Collins, RN, PhD,1,2
1Edward Hines Jr., VA Hospital; 2University of Illinois at Chicago

Rationale: It is estimated that nearly 230,000 Americans are coping with a spinal cord injury (SCI). SCI presents significant health risks secondary to reduced motivation for and challenges to engaging in health-promoting physical activity. Consequently, a sedentary lifestyle is a foremost health risk for countless numbers of individuals who sustain a SCI.

Objective: The purpose of this study was to quantify physical activity in people with a spinal cord injury using accelerometry.

Methods: Fourteen male subjects with a SCI participated in the study. Nine subjects had an upper level injury (mean age = 46.6 ± 15.9 yr) and five subjects had a lower level injury (mean age = 60.0 ± 18.8). Seven subjects were Caucasian, six were African American and one was Hispanic. The average months since injury were 209.4 (range = 0-360). Subjects had an upper level injury (mean age = 46.6 ± 15.9 yr) and five subjects had a lower level injury (mean age = 60.0 ± 18.8). Seven subjects were Caucasian, six were African American and one was Hispanic. The average months since injury were 209.4 (range = 0-360).

Results: Activity levels measured with the Actical follow. Subjects with upper level injuries spent more time in sedentary activities than subjects with lower level injuries.

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Time Spent In Activity Level (min ± SD)</th>
<th>% of day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary Activity</td>
<td>824 ± 355 min</td>
<td>551 ± 152 min</td>
</tr>
<tr>
<td>Light Activity</td>
<td>445 ± 293 min</td>
<td>686 ± 88 min</td>
</tr>
<tr>
<td>Moderate Activity</td>
<td>167 ± 160 min</td>
<td>203 ± 114 min</td>
</tr>
<tr>
<td>Vigorous Activity</td>
<td>4 ± 10 min</td>
<td>0.7 ± 2 min</td>
</tr>
</tbody>
</table>

Conclusion: Subjects tested spent more time in sedentary activities than all others. Additionally, persons with lower level spinal cord injuries were more active than persons with lower level spinal cord injuries.
AN INVESTIGATION OF THE RELATIONSHIP AMONG SOCIAL SUPPORT, FAMILY FUNCTIONING, DEPRESSION AND QUALITY OF LIFE TO MEDICAL ADHERENCE IN CARDIAC REHABILITATION (CR) PATIENTS

Alise G Bartley, PhD; Donna Waechter, PhD; James Rosneck, RN, MS; Richard Josephson, MS, MD; University of Akron; Summa Health System

Rationale: Adherence with medical therapy has been shown to be a concern with patients. Although the effectiveness of CR is well-documented, less than one-third of eligible patients currently take advantage of CR services (AACVPR, 1999). Although there is information available regarding adherence-enhancing strategies while in CR (Oldridge & Jones, 1983), little information is available about which psychosocial variables or combination of variables influence participation. The purpose of this study is to identify psychosocial variables that may predict participation in CR.

Methods: Two hundred sixty patients from a mid-western, medium sized hospital that were diverse in age, cardiac diagnosis, and gender participated in this research. The sample included 75 women and 185 men who had registered for CR orientation before release from the hospital. Of these 260 patients, 130 (50%) participated in CR. One hundred and 85 primary support persons completed the ENRICHD Social Support Inventory (ESSI) and the McMaster Family Assessment Device (FAD). Additionally, the 100 patients completed the BDI and SF-36. Results: Fifty-seven patients entered CR within two months of hospitalization and 43 did not. Seventy five percent were married and 25% were living alone. No statistically significant differences between those who attended and those who did not attend CR were found. Additionally, mean scores for both groups suggest that social support and family functioning were normal for patients and their significant others. Patients in both groups denied depression and scored in the average range on physical and mental composites of the SF-36. Conclusion: Social support, family functioning, depression and quality of life did not predict participation in CR in this sample. Perhaps researchers should search for other variables that may help in predicting participation in CR.

RATINGS OF DIFFICULTY OR PAIN MAY BE BETTER INDICATORS OF FUNCTIONAL DEFICITS THAN LEVEL OF ASSISTANCE IN PATIENTS RECOVERING FROM CORONARY ARTERY BYPASS

Tanya Kinney LaPier, PT, PhD, CCE; Donna Waechter, PhD; James Rosneck, RN, MS; Richard Josephson, MS, MD; University of Akron; Summa Health System

Rationale: The purposes of this pilot study were to describe cognitive performance and relationship to physical function in patients recovering from CAB and to identify psychosocial variables that may predict participation in CR. Methods: This study included 53 patients who had recently undergone CAB. We evaluated ADL performance using 3 subcategories of the Functional Status Index (FSI), mobility, personal care, and hand activities. Under each subcategory of the FSI, subjects rated their level of assistance, difficulty, and pain with activities on a 5-point scale. Subjects completed the FSI 2 weeks and again 2 months following CAB. We used Wilcoxon Signed Ranks Test to compare differences in scores rating assistance to those of difficulty and pain (P < .05).

Results: Scores rating difficulty were lower for all FSI subcategories than scores rating assistance except personal care at 2 months and hand activities at 2 weeks. Perceived difficulty with ADL performance was reported 15-55% more often than need for assistance with ADL. Scores rating pain were lower for all FSI subcategories except hand activities at 2 weeks. ADL limitations due to pain were reported 16-51% more often than need for assistance with ADL. Conclusion: Subjective ratings of difficulty and pain may be more sensitive than level of assistance when evaluating ADL ability in patients recovering from CAB. In this patient population, assessments of functional ability that rely only on level of assistance may underestimate the presence of functional deficits.

COGNITIVE PERFORMANCE AND RELATIONSHIP TO PSYCHOSOCIAL FUNCTIONING IN PATIENTS RECOVERING FROM CORONARY ARTERY BYPASS

Tanya Kinney LaPier, PT, PhD, CCE; Julie Kruth, MS, PhD; St. Luke’s Rehabilitation Institute

Rationale: Cognitive function if often impaired following coronary artery bypass (CAB). It is unclear which areas of cognition may be impaired following CAB and how this is potentially related to psychosocial and physical functioning.

Methodology: This study included 17 patients over 60 years of age attending outpatient cardiac rehabilitation who had undergone CAB within the past 6 months. Subjects completed several tests of cognitive performance using several tests and to examine the relationship between these scores and indices of psychosocial and physical function in patients recovering from CAB. Results: Seventy-five percent were married and 25% were living alone. Forty-nine percent were male. No statistically significant influence of gender on performance was found. Correlations were moderate to strong between cognitive performance and psychosocial variables. Conclusion: Cognitive function if often impaired following CAB and may have important implications for the rehabilitation of patients following CAB.

EFFECT OF GENDER ON CLINICAL RESPONSIVENESS TO THERAPEUTIC LIFESTYLE CHANGES

Marlene Sigler, RN, MS; Richard D. Salmon, DDS; Terri L. Gordon; George C. Fauveloth, MHA; Brenda S. Wright, PhD; Richard F. Leighton, MD; Barry A. Franklin, PhD; Neil Gordon, MD; New Hanover Regional Medical Center; INTERVENT Coordinating Center, Savannah, GA; St. Joseph’s/Candler Health System, Savannah, GA

Rationale: Emerging data have displayed important gender-based differences in the response to cardiovascular disease (CVD) therapies. Although national clinical guidelines promulgate therapeutic lifestyle changes (TLC) as a cornerstone in CVD risk reduction in both men and women, scarce comprehensive data are available on the effect of gender on responses to TLC.

Objectives: In this study, we compared the clinical effectiveness of TLC in 2,144 consecutive men (n = 543; age: 47±10 years) and women (n = 1,601; age: 46±10 years) with an elevated blood pressure, LDL cholesterol, and/or fasting plasma glucose level who were not taking medication for hypertension, hyperlipidemia, or diabetes.

Methodology: Subjects were evaluated at baseline and after approximately 12 weeks of participation in a community-based lifestyle management program. TLC included exercise training, nutrition, weight management, stress management, and smoking cessation interventions. All subjects remained off antihypertensive, antilipemic, and anti diabetic medications throughout the study.

Results: Among subjects with abnormal baseline CVD risk factors (based on national guidelines), clinically relevant improvements (P ≤ .05) were observed for multiple variables, including: systolic/diastolic blood pressure (Men, −5 to −6 mmHg; Women, −10 to −11 mmHg; P ≤ .05 for Men versus Women); LDL cholesterol (Men, −18 mg/dl; Women, −11 mg/dl; P ≤ .05 for Men versus Women); HDL cholesterol (Men, 2 mg/dl; Women, 4 mg/dl; P = NS for Men versus Women); triglycerides (Men, −55 mg/dl; Women, −49 mg/dl; P = NS for Men versus Women); fasting glucose (Men, −10 mg/dl; Women, −9 mg/dl; P ≤ .05 for Men versus Women); and weight (Men, −7 lbs; Women, −5 lbs; P ≤ .05 for Men versus Women). In subjects with a calculated Framingham 10-year coronary heart disease risk score ≥ 20% at baseline, the score decreased significantly (P ≤ .05) in men (−18.8%) and women (−18.9%); P = NS for Men versus Women.

Conclusions: These data demonstrate the similar clinical effectiveness of TLC in men and women with an elevated blood pressure, LDL cholesterol, and/or fasting plasma glucose level.
Poster #8

USE OF THE TRANSTHEORETICAL MODEL IMPROVES ADHERENCE TO SEVERAL HEALTH BEHAVIOR CHANGES IN A CARDIAC REHABILITATION SETTING

Maureen G. Devereaux, OTR/L, CES; Marsha A. Pauly, MS, CES; Teresa Fietek, BS, CES; Stacie Bigelow, MA; Kevin Shores, MA, MEd, RD, Fairview Health Systems

Rationale: The cardiac rehabilitation environment presents an ideal opportunity to provide patients with health behavior change counseling beyond brochures and a one-size-fits-all methodology. The Fairview Health System in Minneapolis, Minnesota has implemented a system-wide initiative of staff training and clinical intervention based on Prochaska’s Transtheoretical Model within its cardiac rehabilitation program.

Methods: Staff training was conducted by a psychotherapist with a specialty in the Transtheoretical Model and health behavior change. Training consisted of classroom education on the use of the model and observation during real interventions. Patients were assessed using the model at the beginning and end of their cardiac rehabilitation treatment for the following behaviors: aerobic exercise, physical activity, low fat eating, smoking cessation and stress management. A standardized set of questions was asked to properly identify the stage of change. Interventions included staged-matched counseling techniques within all points of contact, including education materials, group education sessions, individual sessions, assessment and discharge conversations and during monitored exercise.

Results: 642 patients were followed in 2004 for the low fat eating behavior. Of these patients, 24% were in the action stage at baseline, and 87% were in the action stage at the completion of the program. When assessing the behavior of aerobic exercise, 14% were in the action stage at baseline, and 94% were in the action stage at the completion of the program.

Conclusions: Results suggest that the Transtheoretical Model improves outcomes in a cardiac rehabilitation environment during a six-week intervention. A three-month follow-up session is currently being implemented to determine whether these effects continue after the conclusion of the standard six-week cardiac rehabilitation program.

Poster #9

OBSTACLES TO USING EXERCISE AND REHABILITATION EQUIPMENT FOR PERSONS WITH DISABILITIES

Jill Winters, PhD, RN; Jack M. Winters, PhD, Marquette University

Rationale: The Centers for Disease Control estimated that during 1994-1995, 54 million Americans had one or more disability. Disparity of healthcare services available for persons with disabilities may reflect variability, extent, and nature of health services required, higher need for short- and long-term health services, healthcare reimbursement issues, and lack of accessible medical equipment. Although the 1990 Americans with Disabilities Act stipulated that access to medical care and public accommodations be made for all, many medical devices available today fall short of this requirement.

Objectives: The purpose of this study was to identify the prevalence and specific barriers to using various types of medical equipment by persons with disabilities.

Methodology: An exploratory cross sectional survey design was employed. The target population was a diverse sample of individuals with a wide scope of disabilities. Inclusion criteria consisted of self-report of at least one disability, at least 18 years of age, able to understand English, and experience with medical devices. Data were collected during 2003-2004. Follow-up focus groups are planned for the summer of 2005.

Results: A national consumer survey examining accessibility of medical equipment was completed during 2003-2004. More than 400 respondents completed the survey online, on paper, over the telephone, or in person. Exercise and rehabilitation equipment was identified as the third most difficult category of equipment to use. More than 55 percent of respondents with experience with exercise and rehabilitation equipment identified this category as at least “moderately difficult” to use. This was true across disability groups. Specific issues related to transferring, safety/stability, visual displays, and “correct fit.” Focus groups will refine and target this knowledge.

Conclusions: Many barriers to accessibility and usability of exercise and rehabilitation equipment exist. Further development and research is indicated to make these devices accessible for all, irrespective of level of ability or disability.

Poster #10

EVALUATION OF A COMPREHENSIVE INSTRUMENT FOR MEASURING PSYCHOSOCIAL RISK FACTORS

Kent A. Eichenauer, PsyD,1 Glenn A. Feltz, PsyD,2 Josephine F. Wilson, DDS, PhD,2 1Delta Psychology Center; 2Wittenberg University

Rationale: Anger, anxiety, depression, social isolation and emotional guardedness have all been shown in research to affect cardiopulmonary patients’ risk for future incidence and rehab progress. However, programs generally must instead use several different instruments or neglect one or more factors in their assessment and/or outcomes research. The authors are developing an instrument (Psychosocial Risk Factor Survey—PRFS) to efficiently assess anger/hostility, anxiety, depression, social isolation and emotional guardedness for patients with cardiovascular and pulmonary problems.

Objectives: This research has been designed to measure the construct validity of the five scales of the Psychosocial Risk Factor Survey (PRFS) with the intent of creating an instrument that can help the staff of cardiopulmonary rehabilitation programs assess and assist patients with their psychosocial risk factors.

Methodology: There were 188 cardiopulmonary patients from six cardiopulmonary rehabilitation programs who were administered the PRFS and a combination of the five external measures. These measures include the State-Trait Anger Expression Inventory 2 (STAXI-2), the Beck Anxiety Inventory (BAI), the Beck Depression Inventory 2 (BDI-2), the Life Stressors and Social Resources Inventory-Adult Form (LISRES-A) and the Marlowe Crowne Social Desirability Scale. The individual scales of each psychosocial construct were then compared with the external measures and correlations were analyzed.

Results: The PRFS scales correlated significantly at the 0.01 level (2-tailed) with each of their respective valid construct measures. The PRFS scale correlation coefficients with their respective external measures were: Hostility (r = .68), Anxiety (r = .60), Depression (r = .79), Social Isolation (r = .50-.75) and Emotional Guardedness (r = .40).

Conclusion: The authors conclude that, based on this round of research, this new tool possesses significant construct validity and is ready for the next round of study. This will include reduction to the most efficient items to be included in the abbreviated revision and comparing this revision for validity with the external measures for each psychosocial construct.
Cardiac Rehabilitation

EFFECT OF A COMPREHENSIVE CARDIAC REHABILITATION PROGRAM ON CARDIAC-RELATED EVENTS IN SUBJECTS OF ADVANCED AGE

Patrick Dunn, MS, MBA; Miguel Garnbetta, MD; Ross Arena, PhD, PT; Heart Center, Community Hospital; Virginia Commonwealth University

Rationale: Numerous studies have demonstrated the favorable effect of participation in a cardiac rehabilitation (CR) program. Unfortunately, subjects of advanced age are particularly at risk for lower referral rates to CR. Compounding this clinical pattern is the lack of evidence investigating the beneficial outcomes of CR in individuals of advanced age.

Objectives: To assess the effect of CR on subsequent cardiac-related events in a group of subjects who were 80 years of age or older.

Methodology: A total of 80 subjects were included in this retrospective analysis. Mean age of the overall group was 83.0 years. After suffering an initial cardiac-event requiring angioplasty + drug-eluting stent, 24 (11 male/13 female) of the subjects were enrolled in a comprehensive CR program. The comprehensive CR program lasted 12 weeks. The remaining 54 subjects (29 male/25 female) only received standard care, which entailed routine follow up with their physician. All subjects were tracked for a mean duration of 22.2 months.

Results: Unpaired t-testing revealed mean age between the CR and control group was not significantly different [83.4 vs. 82.6 years, P = .15]. There were 4 and 24 subsequent cardiac-related events in the CR and control group respectively. In both groups, the primary subsequent event was an additional coronary revascularization procedure. Kaplan-Meier analysis revealed 84.6% of the CR group and 55.6% of the control group remained event-free during the tracking period. The difference in cardiac-related events between groups was statistically significant (Log-rank = 6.71, P = .0096).

Conclusion: The results of the present study indicate participation in CR had a positive impact on reducing subsequent cardiac-related events in a group of subjects 80 years of age or older. This finding supports the assertion that advanced age should not be a barrier for referral to CR.

CARDIAC REHABILITATION VIA TELEHEALTH: A UNIVERSITY-BASED PILOT PROGRAM FOR PHYSICAL THERAPY STUDENTS

Donald K. Shaw, PhD, PT; Kenneth E. Sparks, PhD; Texas State University-San Marcos; Department of HPER, Cleveland State University, Cleveland, Ohio

Background: The American Physical Therapy Association estimates less than one percent of American physical therapists (PT's) select cardiac rehabilitation as their primary practice interest. Ironically, a majority of PT's treat older patients for whom cardiac disease is the primary diagnosis. Since few patients participate in formal cardiac rehabilitation programs (<50%), PT's often face the daunting task of providing safe exercise guidelines for patients at home or in outpatient facilities. Students are assigned specific telehealth patients during their cardiopulmonary course work. Faculty members then supervise each student during patient evaluation, formulation of exercise prescription, and monitored sessions. Low income patients are offered the program at no cost while all others pay on a fee for service basis. As the program grows, broadband digital lines will be added to provide rural clinics with clear video and as well as audio capability.

Importance: Goal of the Texas State University Telehealth Program is to promote further PT professional development and enhance cardiac rehabilitation delivery through advances in communication technology.
Poster #13

PATIENT OUTCOME INDICATORS IN CARDIAC REHABILITATION: A DELPHI STUDY

James Rosneck, RN, MS;1 Donna Waechter, PhD; Richard Josephson, MS, MD;1,2 Summa Health System

Background: Cardiac rehabilitation (CR) practitioners recognize that patient centered (POs) outcomes are important measurements of success. However there is a lack of consensus regarding the prioritization of POs and the optimum methodology for their measurement. This research was designed to first identify then rate POs and ultimately rank measurements tools used in their evaluation through the use of the Delphi Technique, a widely recognized and effective tool to narrow general inquiry categories to succinct and specific questions that may be accurately assessed.

Methods: Two hundred experts (AACVPR Fellows) in CR were surveyed by mail with 3 iterations of the Delphi questionnaire to determine short term (ST) and long term (LT) patient indicators of success in CR. Fifty-six respondents rated categories of patient success and ranked importance of methods of assessment in each category.

Results: Four significant outcome themes were identified from common choice indicators; disease risk management, psychological well-being, exercise adherence, and increased work capacity. Disease risk management ranked highest with CAD risk factors and methods of measurement and tracking remaining consistent over time. There was relative lack of support for anthropometric evaluation and weight management. Second in importance was psychosocial well-being. Evaluating QOL, sense of well-being and degree of depression rated above social activity and social support measures. Exercise adherence respondents rated evidence of increased ADLs, weekly aerobic exercise and commitment to a home exercise regimen higher than recreational, strength training and organized maintenance (Phase III) activities. Improvement and maintenance of work capacity were highly rated ST outcomes but their rating decreased markedly for LT analysis giving way to self reported maintenance of home and work activities.

Conclusion: This group of experts identified outcome indicators and their order of importance in evaluating LT & ST patient success in CR and suggested measurement modalities and instruments suitable for assessment.

Poster #14

GAINS IN EXERCISE CAPACITY IN RELATION TO BMI IN A CARDIAC REHABILITATION PROGRAM

Wendy L. Johnson, MS;1 Penny Kardis, MSN; Scott Barnett, PhD;1 Inova Heart and Vascular Institute

Rationale: Current literature suggests healthy or low-BMI individuals experience the greatest increases in exercise minutes relative to high-BMI patients.

Objective: In this paper, we test the hypothesis that low-BMI cardiac rehabilitation patients experience greater gains in exercise capacity compared to high-BMI patients.

Methods: We retrospectively reviewed all patients completing our phase-II cardiac rehabilitation program from 2001 through March 2005. 429 of 556 patients were available for analysis (360 men, 69 women). BMI status was stratified in <25 or ≥25. Linear regression was used to model changes in minutes of exercise from baseline to 3-months by BMI status. Models were also stratified by gender.

Results: Average age was 62.3 years. Average minutes of exercise per week changed from 32.5 to 147.8, a 66.5 minute increase (P < .001). Increased BMI led directly to increased exercise minutes (F = 7.0, P < .001). Patients with increased BMI experienced a 98% increase in exercise minutes from baseline to 3-months compared to only a 50% increase for low BMI patients (P < .05). When stratified by gender, increased BMI led directly to increased minutes of exercise among both male (F = 165.1, P < .001) and female (F = 38.0, P < .001) patients.

Conclusion: Patients with a BMI ≥25 experienced a 98% increase in exercise capacity vs. BMI ≤25 (50%, P < .05). Following 12 weeks of cardiac rehab, both groups were able to exercise at the same capacity. The implications for those with BMI ≥25 will further support the data on secondary improvement in cardiac risk status resulting in better lipid profiles, improved resting blood pressures, improvements in diabetic status and quality of life issues regardless of weight loss.

Poster #15

ESTABLISHING A WEB BASED EVALUATION PROGRAM FOR BENCHMARKING OUTCOMES OF CARDIAC AND PULMONARY REHABILITATION PROGRAMS IN NEW YORK STATE

Manoj Mithal, MBBS, PhD; Michael J. Manfre, MEc;1 UB Dept. of Physical Medicine and Rehabilitation;2 St. Francis Hospital

Rationale: Outcome measures (OCMs) are beneficial for patient care and program effectiveness. This project aims at establishing an online evaluation program for benchmarking outcomes of cardiac and pulmonary rehabilitation programs in New York State.

Objectives: Identifying outcomes cardiac (CR) and pulmonary rehabilitation (PR) programs are measuring and collect data on selected measures that meet AACVPR Program Certification Standards. Establish an online evaluation program for benchmarking outcomes of cardiac and pulmonary rehabilitation programs in New York State.

Methodology: After validation, an initial phase I survey will be posted on the NYSACPR website. Results will be collated and analyzed using descriptive statistics. A phase II survey of selected OCM’s based on frequency of use in phase I and application standards for AACVPR Program certification will be posted on the NYSACPR website. Data collected using the phase II survey will be collated and analyzed.

Results: The (phase I) survey tool was posted on NYSACPR website from November 15th 2004 till January 15th 2005. A total of 32 CR and PR Programs completed the survey. The data collected was collated and analyzed using descriptive statistics. Based on the results of the (phase I) survey, the (phase II) survey was designed. The OCM measures included in this survey are: a) Which were most commonly reported as being measured by the cardiac and pulmonary rehabilitation, programs in the phase I and b) which confirm to the application standards for AACVPR Program certification. The phase II survey will be available on the NYSACPR website till 4/30/05.

Conclusion: The project demonstrates the usefulness of web-based research in collecting outcomes data. The use of the web eliminates the chances of error during data entry. Results of the phase II survey will be used for benchmarking outcomes of cardiac and pulmonary rehabilitation programs in New York State.

Poster #16

TRENDS IN PRE AND POST PREDICTED VO2 MAX MEASUREMENTS FOR PHASE II CARDIAC REHABILITATION PATIENTS

Travis Sweet, MS, Fairview

Background: Currently there are varying views on which specific diagnosis of heart patients achieve the most benefit/gain from attending phase II cardiac rehabilitation. The purpose of this study was to determine if there are significant differences in pre and post predicted VO2 max measurements among stable angina, acute myocardial infarction (AMI), CAD, PTCA/stent, and valve replacement/repair phase II cardiac rehabilitation patients.

Methods: The study included 295 male and 116 female patients with one of the above diagnosis who took part in at least 11 one hour sessions of phase II cardiac rehabilitation. Pre and Post VO2 measurements were calculated (VO2 max: 65 + [1.8 * [frequency of exercise]] – (10 * [male]) – (0.3 * [age]) – (0.6 * [BMI]) for patients during their first and last rehabilitation sessions.

Results: The results showed that all diagnosis of patients improved their VO2 max significantly from pre to post rehabilitation. While variation in pre and post VO2 max measurements were found during this study among the different diagnosis, these findings were not statistically significant differences.

Conclusion: While cardiac rehabilitation does not benefit a specific heart patient diagnosis significantly more than another, cardiac rehabilitation in of its self significantly improves the post VO2 max measurements for all diagnosis’ of heart patients.
EFFECT OF AGE ON QUALITY OF LIFE FOLLOWING CARDIAC REHABILITATION

Penny Kardis, RN, MSN; Wendy Johnson, RN; Scott Barnett, PhD; Richard D. Salmon, DDS; Brenda S. Wright, PhD; Ross Arena, PhD, PT; James Arrowood, MD; Ding-Yu Fei, PhD; Kenneth A. Krafl, PhD, Virginia Commonwealth University

Rationale: Cardiac rehabilitation (CR) facilitates improvement in the physical status and emotional well being among patients following a life threatening cardiac event. Research suggests older patients demonstrate significant improvements in CR compared to younger patients.

Objective: Using data from our phase II CR program, we sought to test the hypothesis that younger patients can experience similar gains in QOL following CR compared to older patients.

Methods: We retrospectively reviewed all patients from 2001 through March 2005. Patients were stratified into 3 age groups (<50, 51-65, >65). QOL was assessed using the Dartmouth Primary Care Cooperative (COOP). Lower scores indicate increased QOL. Repeated measures ANOVA was used to test age group and QOL gains pre and post-CR.

Results: CR subjects (n = 556) were predominantly male (82.0 %), CABG recipients (50.5%) and averaged 27.4 visits for the 3 month period. Statistically significant changes (P < .01) in QOL from baseline to month 3 were seen for Daily Activities, Feelings, Overall Health, Pain, Physical Fitness, and Quality of Life. Statistically significant changes in QOL from baseline to month 3, adjusted for age, were seen for Overall Health (F = 3.27, P < .039) and Pain (F = 5.40, P < .005). Increasing age led to increasing numbers of statistically significant changes from baseline: <=50 4/9 COOP subscales, 51-65 (7/9 COOP subscales) and >65 (7/9 COOP subscales).

Conclusion: Significant improvements in QOL following cardiac rehabilitation were seen across 6/9 COOP subscales from baseline to 3-months. Statistically significant QOL improvements adjusted by age were seen for only 2/9 COOP subscales, showing that older adults have higher levels of Overall Health and less Pain following cardiac rehabilitation. These results suggest that while CR benefits all patients, younger patients experience equal gains in QOL.

MULTI-CENTER STUDY OF RISK FACTOR STATUS ON COMPLETION OF A CONTEMPORARY PHASE 2 CARDIAC REHABILITATION PROGRAM: MALE VERSUS FEMALE PATIENTS

Diane Vogel, RN, BS; Barry A. Franklin, PhD; Richard D. Salmon, DDS; Kevin S. Reid, MA; William E. Saxon, ASRT; George C. Fairecloth, MHA; Brenda S. Wright, PhD; Richard F. Leighton, MD; Neil Gordon, MD; Brenda S. Wright, PhD; Ross Arena, PhD, PT; James Arrowood, MD; Ding-yu Fei, PhD; Kenneth A. Krafl, PhD; Virginia Commonwealth University

Rationale: No comprehensive gender-specific data are available on the percentage of participants who are still not at recommended cardiovascular disease (CVD) risk factor goal levels on completion of a contemporary phase 2 cardiac rehabilitation (CR) program and, therefore, in need of additional intervention.

Objective: In this multi-center study, we compared the percentage of participants not at goal for select risk factors in male versus female patients on exit from a phase 2 CR program.

Methods: Subjects were 4,873 consecutive male (Group A; n = 3,511; age: 66 +/- 11 years) and female (Group B; n = 1,362; age: 68 +/- 11 years) patients who enrolled in a phase 2 CR program at 30 centers in the United States after May 16, 2001 (i.e., the publication date of the National Cholesterol Education Program Adult Treatment Panel III Guidelines) and subsequently completed an exit evaluation on program completion. Risk factors were evaluated using standardized procedures.

Results: Results are shown in the table.

Conclusion: These data indicate that multiple CVD risk factors are often inadequately controlled on exit from a contemporary phase 2 CR program. Our findings further indicate that gender-specific differences exist for multiple risk factors. These data emphasize the urgent need for ongoing risk reduction interventions in post-phase 2 CR program participants.

CORRELATION BETWEEN C-REACTIVE PROTEIN AND CHOLESTEROL IN APPARENTLY HEALTHY ADULTS: THE INFLUENCE OF GENDER

Ross Arena, PhD, PT; James Arrowood, MD; Ding-Yu Fei, PhD; Kenneth A. Krafl, PhD, Virginia Commonwealth University

Rationale: C-reactive protein (CRP) has emerged as an important indicator of risk for cardiovascular disease. Recent research has found statin-therapy has a positive impact on CRP levels.

Objective: To assess the relationship between CRP and lipids in apparently healthy male and female groups.

Methods: 88 males and 74 females participated in this study. Age, systolic and diastolic blood pressure (SBP/DBP), body mass index (BMI), Cholesterol (TC, HDL, LDL, TG), aortic wave velocity (AWV), maximal oxygen consumption (VO2max), percent VO2max, predicted and CRP were ascertained.

Results: All unpaired t-test results are reported male vs. female group: Age [51.1 (± 15.9) vs. 49.3 (± 18.5) years]. SBP [125.0 (±17.3) vs. 126.3 (±18.5) mmHg], DBP [73.8 (±10.1) vs. 73.6 (±9.1) mmHg], BMI [25.0 (±3.3) vs. 25.5 (±3.8) kg/m2], AWV [6.3 (±2.0) vs. 6.8 (±1.9) m/sec], percent VO2max, predicted [117.7 (±0.35) vs. 116.3 (±0.35 %)], LDL [118.1 (±30.0) vs. 116.4 (±28.9) mg/dl] and TG [118.8 (±31.9) vs. 105.8 (±57.9) mg/dl] were not significantly different. TC [188.9 (±33.4) vs. 200.3 (±33.1) mg/dl], HDL [53.8 (±12.3) vs. 68.6 (±20.3) mg/dl] and CRP [1079 (±1168.6) vs. 2120.4 (±2900.8) ng/ml] were significantly lower in the male group (P < .03). In the male group, CRP was not significantly correlated with TC (r = .05), LDL (r = .08), LDL (r = .03) or TG (r = .01). In the female group, CRP was significantly correlated with TC (r = .31), LDL (r = .30) and TG (r = .54) although it was not significantly correlated with HDL (r = .14).

Conclusions: The results of the present study indicate the relationship between CRP and lipids may be different between a healthy males and females. The prognostic characteristics of CRP and impact of statin therapy on CRP may therefore differ between males and females. Future research should be directed toward resolving this issue.
DOES SITTING POSTURE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE REALLY MATTER?: AN ANALYSIS OF TWO SITTING POSTURES AND THEIR EFFECT ON PULMONARY AND CARDIOVASCULAR FUNCTION

Merrill R. Landers, DPT, OCS; 1 James W. McWhorter, MPT, PhD; Danylle Filibeck, MSPT; Christy Robinson, MSPT; 2University of Nevada, Las Vegas

Rationale: Previous research has demonstrated that healthy individuals who maintain a slumped seated position have a decrease in pulmonary function when compared to an upright seated position.

Objectives: The purpose of this study was to investigate the changes that occur in pulmonary function when postural changes in the sagittal plane are made in a seated position in patients diagnosed with chronic obstructive pulmonary disease (COPD).

Methods: Nineteen patients (mean age = 70.4, mean BMI = 29.5) with a medical diagnosis of COPD were recruited to participate in this study. Standard spirometric measurements (minute ventilation (VE), forced vital capacity (FVC), and forced expiratory volume in one second (FEV1)) were taken for each patient in each of two sitting postures, slumped and upright. Breathing frequency (bf), heart rate (HR), and blood oxygen saturation (O2 sat) were also recorded for each of the two postures. Patients assumed each posture for 5 minutes before any measurements were taken, after which time measurements were recorded each minute for an additional 5 minutes.

Results: A two factor (posture and time) ANOVA with repeated measures on both factors was used to analyze the data. There were no significant differences between the means for HR, O2 sat, and bf (Ps > .05). Paired t-tests likewise did not reveal any significant differences between the slumped and upright positions for FEV1, FVC, and VE (Ps > .05).

Conclusion: These results suggest that there are no differences in measures of pulmonary function (VE, FVC, and FEV1) and breathing frequency, heart rate, and O2 saturation between slumped and upright sitting in patients with COPD. Unlike healthy subjects who demonstrate improved pulmonary function with upright posture, patients with COPD may not demonstrate the same benefit because a slumped posture may actually place the characteristic flattened diaphragm in a more advantageous biomechanical position than would an upright posture.

COMPARISON OF CAPILLARY AND VENOUS INSULIN RESPONSES

Megan L. Renneberg, MS; 1 Carl Foster, PhD; Margaret A. Maher, PhD; Rebecca Battista, PhD; John P. Porcari, PhD; 1University of Wisconsin-La Crosse

Rationale: Hyperinsulinemia is an important issue in terms of the obesity epidemic sweeping the developed world. Measurement of insulin (INS) is critical to understanding the value of various interventions, however making large numbers of venous measurements is inconvenient.

Objective: This study was designed to compare the INS responses in capillary and venous blood samples obtained simultaneously following various dietary interventions.

Methodology: Volunteer subjects (age 22–35) (n = 10) had simultaneous capillary and venous blood samples drawn before and 60-min after ingesting either a regular (R) soft drink (both with and without caffeine (C)) or a diet (D) soft drink (both with and without C). Samples were analyzed for INS with ELISA.

Results: Although there were some significant differences in absolute values of INS measured in capillary vs venous blood, pre to post changes in INS were very similar between C vs nonC (RCcap = 8.4 to 9.4 vs RCven = 5.7 to 9.9; RnoCcap = 4.6 to 7.1 vs RnoCven = 4.3 to 10.0; DCcap = 4.6 to 4.4 vs DCven = 5.4 to 4.5; DnoCcap = 4.6 to 4.4 vs DnoCven = 5.1 to 4.6). The combined capillary vs venous changes were well correlated (r = 0.91).

Conclusion: Although there are slight differences in the absolute values of INS measured in capillary vs venous blood samples, the differences are well correlated (r = 0.91) and highly predictable (Ven INS = 0.53 + 0.976 Cap INS).

RELATIONSHIP BETWEEN STRESS-INDUCED MYOCARDIAL ISCHEMIA, METABOLIC SYNDROME AND ATHEROSCLEROSIS MEASURED BY CORONARY CALCIUM TOMOGRAPHY IN ELDERLY PATIENTS

Pedro Fernandez del a Vega, MD; 1 A. Graef, MD; J. Flores, MD; J. Hernandez, MD; R. Corona, MD; R. Lima, MD; 1Medica Sur, Mexico City, Mexico

Objectives: We assessed the relationship between stress-induced myocardial ischemia on myocardial perfusion single-photon emission computed tomography (MPS) and magnitude of coronary risk factors (CRF), coronary artery calcification (CAC) by X-ray tomography in 28 elderly patients undergoing both tests. There has been little evaluation regarding the relationship between metabolic syndrome, inducible ischemia or parameters that might modify this relationship.

Methods: A total of 28 patients with known coronary disease, all asymptomatic underwent coronary risk factors (Cooper and Framingham classification) Stress MPS and CAC tomography within 60 days. The frequency of ischemia by MPS was compared to the magnitude of CRF and CAC abnormality.

Results: Among 28 patients (65 +/- 8 years) with ischemic MPS, the CAC scores were 0–99 in 21%, 100–399 in 18%, 400–999 in 18%; and >1000 in 43%. The frequency of ischemic MPS was <39% with CAC scores <400 and increased progressively with CAC >400 (P for trend <0.01). Elderly patients with symptoms, and high CRF (Cooper and Framingham) with CAC scores >400 had increased likelihood of MPS ischemia versus those without symptoms (P = .025). Absolute rather than percentile CAC score was the most potent predictor of MPS ischemia by multivariable analysis. Importantly, 61% of patients with abnormal MPS had CAC scores >400; 61% with light ischemia and 39% with moderate to severe ischemia.

Conclusions: Ischemic MPS is associated with a high likelihood of clinical atherosclerosis by CAC, but is rarely seen for CAC scores <100 (21%). A high calcium score cannot be interpreted properly in the absence of information on the underlying coronary risk assessment; in patients with metabolic syndrome.
Poster #24

VALIDATION OF NEWLEAF VO2 TESTING

Donna M. Polk, MD, MPH; Timothy Graves, MS; Samantha Lewis, BA; Richard Gordon, MA; Maura Paul-Labrador, MPH; Holden McRae, PhD; C. Noel Bairey Merz, MD; Cedars-Sinai Medical Center; Pepperdine University

Introduction: VO2 testing provides an accurate measure of aerobic fitness, however utilization is limited due to availability and expense of a metabolic cart testing. The NewLeaf VO2 testing system is a commercially available portable gas exchange measurement system. We comparatively tested the NewLeaf VO2 system against metabolic cart testing.

Methods: 20 healthy men and women volunteers were randomized to undergo maximal VO2 testing using a Medical Graphics Cardio O2 metabolic cart, or New Leaf VO2 testing system, using a modified Bruce protocol. A repeat maximal VO2 test was then performed on the alternate system within 8 days of the first one to reduce training effects.

Results: Overall, 65% of participants were female, average age was 36.2 yrs, and BMI was 26.9 kg/m2. The mean difference in VO2 max between tests was 0.805 ml/min (SD ± 6.27). The intra-class correlation coefficient was 0.81 (P < .0001). Measured VO2 over time by both systems is seen in figure below. A nonsignificant trend towards a variation in VO2 max between systems was observed among premenopausal women (83%) compared to post-menopausal women (17%) and men combined (P = .11).

Conclusions: New Leaf VO2 testing system measures max VO2 with high precision and validity compared to metabolic cart testing. These results support the use of the NewLeaf VO2 testing system in a variety of settings.

Poster #23

SHORT-TERM RELIABILITY OF OXYGEN UPTAKE ON-KINETICS IN APPARENTLY HEALTHY SUBJECTS

Ross Arena, PhD, PT; Mary Ann Peberdy, MD; Michael Tevald, MPT, Virginia Commonwealth University

Rationale: The analysis of oxygen (O2) uptake on-kinetics has been shown to be reflective of cardiovascular and musculoskeletal function. While the amount of evidence demonstrating the clinical validity of this variable is robust, debate over defining a reliable method for the measurement of O2 uptake on-kinetics continues.

Objectives: To assess the short-term reliability of O2 uptake on-kinetics in a group of apparently healthy individuals.

Methodology: Forty apparently healthy subjects (20 male/20 female) participated in treadmill exercise sessions on three consecutive days. Subjects were instructed to maintain a similar physical activity pattern during the three-day period. During each session, O2 uptake was collected at rest for two minutes and during ambulation at 2.2 miles per hour and 6% grade for six minutes. Breath-by-breath O2 uptake data was averaged over 10-second intervals before data analysis. Resting O2 uptake was defined as the averaged value of two minutes of data in the seated position. Steady-state O2 uptake was the averaged value during the final two minutes of the exercise session. The time constant (TC) for the O2 uptake on-kinetics was calculated for each of the three sessions using the equation: VO2(t/TC) = VO2(resting) * e^(-(t/TC)).

Results: Two male subjects did not maintain a similar activity pattern and were excluded from data analysis. The intraclass correlation coefficient for resting O2 uptake, steady-state O2 uptake and the O2 uptake TC was 0.92, 0.98 and 0.84 respectively. The standard error of measurement, with 95% confidence bounds, for the O2 uptake TC was ±5.77 seconds.

Conclusion: These results of the present study indicate O2 uptake on-kinetics may be reliably measured using a single testing session. Future research should be directed toward determining if O2 uptake on-kinetics is equally reliable in other populations such as those diagnosed with heart failure.

Poster #25

ONE REPETITION MAXIMUM STRENGTH TEST IN HEART FAILURE

Paleto, Gregory MS; Pearce, Douglas J. MD; Aaron, Mark F. MD; Saint Thomas Hospital

Purpose: Determine a starting test weight, using percent body weight for use with a one repetition maximum (1 RM) protocol for participants with left ventricular dysfunction.

Methods: Six male participants with a mean age 66.8 ± 13.7 years with a documented history of left ventricular dysfunction (mean EF 43.5 ± 8.8%). Participants performed a preliminary low repetition RM at 30%, 40%, and 50% of their body weight. A 1 RM was also performed for comparison purposes. Each low RM value was used to predict the participants 1 RM.

Results: The three workloads were all highly correlated with measured 1 RM. The highest correlation was the 50% prediction weight (0.983 P < .001). Hemodynamic responses during the three workloads and 1 RM test followed normal physiological responses.

Discussion: The true 1 RM measured was 53.8% of the participants’ body weight. Stable heart failure patients can safely lift 50% of their body weight to determine their maximum repetition strength for upper body. Hemodynamic results measured during the test demonstrated normal physiological results.
EXERCISE CAPACITY EXPLAINS THE RELATIONSHIP BETWEEN DEPRESSION AND HEART RATE RECOVERY AFTER TREADMILL STRESS TESTING

Joel W. Hughes, PhD; Elizabeth Casey, BA; Faith Luyster, BA; Vicki H. Doe, MA; Donna Waechter, PhD; James Rosneck, RN, MS; Richard Josephson, MS, MD; Kent State University; Summa Health System

Rationale and Objectives: Depression increases risk of mortality among cardiac patients, which may be due to altered autonomic nervous system (ANS) functioning. The rate at which heart rate (HR) returns to baseline after treadmill stress testing predicts subsequent cardiac mortality. Because heart rate recovery (HRR) is controlled by the ANS, depression may predict HRR. Furthermore, exercise capacity may explain this relationship. This study examined the relationship between depression and HRR among cardiac rehabilitation patients, testing the hypothesis that exercise capacity would account for the relationship between depression and HRR.

Methodology: The Beck Depression Inventory (BDI) was prospectively administered to 244 patients prior to beginning a phase II cardiac rehabilitation program. Participants also completed an exercise stress test yielding HRR and exercise capacity (METs). The rate at which heart rate (HR) returns to baseline after treadmill stress testing predicts subsequent cardiac mortality. Because heart rate recovery (HRR) is controlled by the ANS, depression may predict HRR. Furthermore, exercise capacity may explain this relationship. This study examined the relationship between depression and HRR among cardiac rehabilitation patients, testing the hypothesis that exercise capacity would account for the relationship between depression and HRR. BDI score, age, resting HR, maximum HR, and METS accounted for 63% of the variance in HRR. Higher levels of depressive symptoms predict poorer HRR, which appears to be partly accounted for by exercise capacity. Limitations include the cross-sectional design and small sample size. Although HRR is an imperfect measure of ANS control of HR, the relationship between depression and exercise capacity may help to explain the association of depression and ANS functioning.

Conclusion:

CRITERION-RELATED VALIDATION OF THE VENTILATORY RESPONSE INDEX FOR TREADMILL EXERCISE

H. Steven Sadowsky, PT, RRT, MS, CCS, Northwestern University

Rationale: Although a number of tools exist for the purpose of modulating or prescribing exercise intensity, there are numerous reasons why each is less than ideal for many portions of the exercising public. Alternatively, the ventilatory response index (a relative measure of one’s ability to breathe during exercise) is a simple, “no instruments required” clinical tool that can be used to modulate or prescribe exercise intensity.

Objectives: Examinations of concurrent and construct validity of the ventilatory response index were made using apparently healthy adults.

Methodology: Concurrent validity was determined for the ventilatory response index (VRI) by assessing its correlation with oxygen consumption (VO2), heart rate (HR), venous lactate concentration ([Lac]), and rating of perceived exertion (RPE, Borg’s 6–20 scale) responses to speed- and grade-incremented treadmill tests. Because VO2 and VRI involve mutually exclusive determinations (one with expired gas analysis; one without), the order of the two testing procedures was randomly assigned in an a priori manner. Heart rate, [Lac], and RPE were measured during each stage of both tests. Construct validity was established by assessing differences between values of VO2, HR and RPE obtained during steady-state exercise at VRI level 2 with those corresponding with VRI level 2 during the incremental tests.

Results: Repeated measures ANOVA showed no differences between the two test conditions for HR, [Lac], RPE, or exercise duration. Correlation/regression analyses showed the VRI to be a positive linear function of V̇O2, HR, [Lac], and RPE (r = 0.96, 0.92, 0.89, and 0.77; P < .01, respectively). Paired t-tests showed no significant differences between VRI level 2 values for VO2, HR, or RPE obtained during incremental or steady-state exercise.

Conclusion: These results provide concurrent and construct evidence to support the use of the VRI to modulate or prescribe exercise for apparently healthy adults.

INADEQUACY OF %HRMAX TO DEFINE INTENSITY AT VENTILATORY THRESHOLD

Carl Foster, PhD; Amanda Ingli, MS; Rebecca Battista, PhD; John Greany, MS; PT; John P. Porcari, PhD, University of Wisconsin-La Crosse

Rationale: The exercise prescription is often written in terms of the relative intensity of exercise defined by %HRmax. However, many physiologists believe that an exercise intensity near the ventilatory threshold (VT) may be a more nearly optimal exercise training intensity. Various authorities have suggested that VT can be conveniently defined in terms of 80 %HRmax, although documentation of the closeness of this relationship is lacking.

Objectives: This study was designed to evaluate how accurately a fixed %HRmax defined HR @ VT.

Methodology: Healthy volunteers (age 18–44) (n = 22) (VO2max = 50 ± 8 ml/kg) performed maximal treadmill exercise with gas exchange to define HRmax and HR @ VT. The %HRmax @ VT was compared to test the hypothesis that 80 %HRmax could define VT.

Results: VT was observed at a VO2 of 2.90 ± 0.69 (66% VO2max). HR @ VT was 82 ± 5 %HRmax, near the hypothesized value. However, the correlation between HR @ 80 %HRmax and HR @ VT was not strong (r = 0.64) and the range of %HRmax @ VT (71–89 %) was quite wide.

Conclusion: We conclude that although 80 %HRmax is a good average approximation of the intensity of VT, the relationship is not close enough for routine use in exercise prescription.

EXPERIMENTAL TEST OF THE CONCEPT OF VO2MAX

Carl Foster, PhD; Nicole Bradley, MS; Kris Greany, RD, MS; Rebecca Battista, PhD; Glenn Wright, PhD; John P. Porcari, PhD, University of Wisconsin-La Crosse

Rationale: Maximal oxygen uptake (VO2max) has defined the concept of exercise capacity and endurance performance for more than half a century. The concept of a plateau of VO2 despite increasing muscle power output is a central tenant in the concept of VO2max. Recently, the concept of VO2max has been challenged, with suggestions that the plateau is more an artifact of testing procedures than of physiology.

Objectives: This study was designed to compare VO2 responses during sequentially administered exercise tests, with an increased workload during the second test, to evaluate the presence of a plateau of VO2.

Methodology: Competitive runners (6m,6f) performed incremental (3-min stages) treadmill exercise to fatigue, walked to recover for 3-min, then exercised for up to an additional 3-min at a faster pace (10.0 ± 0.85 vs 11.0 ± 0.85 mph).

Results: During Run 1 the subjects did not consistently demonstrate criteria for a plateau of VO2. However, comparing Run 1 vs Run 2, there were no significant (P < .05) differences in VO2max (4.09 ± 0.97 vs 4.01 ± 1.16 L/min), VO2max (126 ± 29 vs 126 ± 35 L/min), or HRmax (184 ± 6 vs 181 ± 10 bpm). There were significant differences in VO2max (4.40 ± 1.08 vs 4.06 ± 1.27 L/min) and RER (1.07 ± 0.06 vs 1.00 ± 0.06). There was some evidence of a differential effect for VO2max in Run 1 vs Run 2 in males (4.97 ± 0.41 vs 5.07 ± 0.40 L/min) vs females (3.21 ± 0.21 vs 2.99 ± 0.46 L/min).

Conclusion: The present data are supportive of the concept that VO2 plateaus during successive heavy exercise bouts with an increase in workload, and as such supports the traditional concept of VO2max.
**Poster #30**

**PHYSIOLOGICAL RESPONSES TO PILATES AND YOGA TRAINING**

Stefanie A. Spildev, MS; John P. Porcari, PhD; John Greany, MS, PT; Scott Doberstein, MS, ATC; Carl Foster, PhD; University of Wisconsin-La Crosse

**Rationale:** Pilates and yoga gained in popularity throughout the 1990’s and have continued to attract new participants. While neither discipline has traditionally been defined as aerobic, many make claims that they are. To date, few studies have been completed that have investigated the aerobic component of each discipline.

**Objective:** This study was designed to study whether or not Pilates or yoga provide an adequate stimulus for aerobic conditioning, defined by ACSM as 55-90% of HRmax or 45-85% of VO2max.

**Methodology:** Volunteer subjects (age 18-26) (n = 30) were assigned to one of the disciplines, based on experience. Each subject performed a maximal treadmill test using the Balke protocol and then completed two taped 50-minute sessions in their discipline at two different levels of intensity.

**Results:** During the Pilates sessions, the subjects worked at an average of 54 ± 3.6% of HRmax and 28 ± 4.3% of VO2max during a beginner workout and at an average of 62 ± 4.0% HRmax and 43 ± 5.3% VO2max during an advanced workout. During the yoga sessions, the average percent of HRmax during Hatha yoga was 48 ± 3.4 and 24 ± 4.1% of VO2max, and during power yoga, subjects averaged 62 ± 5.4% of HRmax and 46 ± 4.8% of VO2max.

**Conclusion:** Based on the results of this study, both yoga and Pilates provide a low to moderate intensity aerobic workout. When practiced at a high skill level, both can become intense enough to elicit moderate improvements in aerobic capacity.

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**Poster #32**

**VALIDITY OF THE COUNTING TALK TEST COMPARED TO OXYGEN CONSUMPTION FOR ESTIMATING EXERCISE INTENSITY**

Elizabeth Hopkins, BS; Erin Crapo, BA; Joseph Norman, PhD, PT; University of Nebraska Medical Center

**Rationale:** The Talk Test is used as a means of defining the upper limit of exercise intensity for cardiorespiratory training. However, it does not provide feedback as to the lower limits that can produce health and fitness benefits.

**Objective:** This study evaluated the relationship between a variation of the Talk Test, the Counting Talk Test (CTT), and the criterion measure of oxygen consumption (VO2) for estimating upper and lower exercise intensities.

**Methods:** Twenty individuals (12 F and 8 M), mean age 23.8 ± 1.8 years, participated in two maximum-effort exercise tests. During the first test subjects walked/jogged on a treadmill from 40% of their predicted heart rate reserve (HRR) to maximum effort. VO2, heart rate (HR) and blood pressure (BP) were obtained. At the second session, subjects were instructed in the CTT. At rest, subjects took a deep breath and counted out loud (one-one thousand, two-one thousand, etc.) at their usual talking speed. The highest count obtained, before taking a second breath, was recorded as the resting CTT value. Subjects were then tested on the treadmill from 40% of their actual HR to maximum effort. BP, HR and CTT scores were obtained at each workload. The % of resting CTT (%CTT) was calculated for each workload. Pearson correlations were performed to determine the relationship of the CTT to %VO2-R and %VO2-max.

**Results:** Moderate to strong correlations were found between the %CTT value and %VO2-R (r = .78, P < .001) and %VO2-max (r = .79, P < .001). Exercising at 30%-50% of the resting CTT value corresponded to ACSM = s recommended guidelines of 40/50%-85% VO2-R (50% CTT = 40% VO2-R and 30% CTT = 75% VO2-R).

**Conclusions:** The CTT is well correlated to the %VO2-R. These preliminary findings support the CTT as a valid method for defining an upper and lower exercise intensity range.
**Exercise Training**

**Poster #33**

**INCREASED MOBILITY IN THE OBESE ELDERLY WITH OSTEOARTHRITIS OF THE KNEE—A HOME-BASED WALKING AND STRENGTH TRAINING PROGRAM**

Christine Bammert, MS; Susan O’Connell, RN, MHA; Scott Miskevics, BS; Eileen Collins, PhD, RN; Elly Budiman-Mak, MD, MPH; Edward Hines Jr. VA Hospital, Hines, IL

**Rationale:** Osteoarthritis (OA) is a leading chronic illness among older adults in the United States, and is second only to heart disease as a cause of inactivity for men 65 yr and older. Approximately 40% of individuals over 60 yr of age have OA of the knee, resulting in weakened muscles of the involved joints, immobility, and weight gain.

**Objective:** The purpose of this study was to determine whether overweight individuals with knee OA who completed a 16-week home-based walking and strength training exercise program would significantly increase walking distance, walking speed and quadriceps strength, and decrease body fatness and body weight.

**Methods:** Fifty-six sedentary subjects (50 men/6 women), mean age of 68 ± 8 years, with a diagnosis of knee OA by radiographic changes of Kellgren-Lawrence grade 2-4, and Body Mass Index (BMI) greater than 27 (34 ± 6) participated in a balanced Polestriding/walking program combined with isometric strength training. BMI, body composition (Bod Pod, LMI Inc.), isometric leg strength (index leg), 6-minute walk speed (m/sec) and distance (m), and perceived physical function via the Western Ontario and McMaster University (WOMAC) were measured at baseline and 16 weeks.

**Results:** Subjects increased walking speed (.14 ± .13 m/s), distance covered in 6 minutes (49.7 ± 42 m) and leg strength (13 ± 23 lbs.) Modest changes were observed in body composition; body fat percent lost was 1.4 ± 4%, pounds lost 3.4 ± 9, and BMI remained unchanged. Physical function (WOMAC) improved by 18%.

**Conclusions:** Combined walking and resistance training exercise increases walking speed, walking distance, quadriceps strength, and perceived physical function and reduces body fatness and weight in the overweight elderly with knee OA.

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**Poster #34**

**COMPARISON OF THE COUNTING TALK TEST METHOD WITH HEART RATE MEASURES AND RATING OF PERCEIVED EXERTION FOR ESTIMATING EXERCISE INTENSITY**

Erin Crapo, BA; Elizabeth Hopkins, BS; Joseph Norman, PhD, PT; University of Nebraska Medical Center

**Rationale:** Exercise intensity is frequently based upon heart rate (HR), rating of perceived exertion (RPE), or the Talk Test, which identifies the upper but not lower limits of exercise intensity.

**Objective:** The purpose of this study was to evaluate the relationship between the novel Counting Talk Test (CTT) for estimating upper and lower exercise intensity ranges and 1) heart rate reserve (HRmax), 2) maximum heart rate (HRmax), and 3) Borg’s Rating of Perceived Exertion (RPE).

**Methods:** Twenty individuals (12 F and 8 M), mean age 23.8 ± 1.8 years, participated in two exercise tests. The first test consisted of subjects exercising on a treadmill from 40% of their predicted heart rate reserve (HRHRmax) to maximum effort. HR, RPE and blood pressure (BP) were obtained at each stage. On the second test, subjects were instructed in the CTT method. At rest, subjects took a deep breath and counted out loud (one-one thousand, two-one thousand, etc.) at their usual talking speed. The highest count obtained, before taking a second breath, was recorded as the resting CTT value. Subjects were then tested on the treadmill from 40% of their actual HR to maximum effort. HR, BP, RPE and CTT scores were obtained at each workload. The % of resting CTT (%CTT) was calculated for each workload. Pearson correlations were performed to evaluate the relationships.

**Results:** Moderate to strong correlations were found between the %CTT value and %HRmax (r = .85, P < .001), %HRmax (r = .78, P < .001), and RPE (r = -.71, P < .001). Exercising at 30–50% of the resting CTT value corresponded to ACSM’s exercise guidelines for moderate to vigorous exercise intensity (40–85% HRmax, 60–90% HRmax, and RPE of 10–17).

**Conclusion:** The CTT method compares favorably to the standard field measures used to establish exercise intensity ranges in the moderate to vigorous activity level.

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**Poster #35**

**EFFECTS OF MUSIC, PERCUSSION AND METRONOME RHYTHMS ON EXERCISE INTENSITY**

Lisa J. Gaisor, MS; Carl Foster, PhD; Karen Palmer-McLean, PhD, PT; Scott Doberstein, MS, ATC; John P. Porcari, PhD; University of Wisconsin-La Crosse

**Rationale:** Previous studies have shown that there is a positive effect of music tempo on exercise performance regardless of music genre. It is unclear what aspect of the music (melodic elements + percussion, percussion, simple rhythm) causes participants to increase work output.

**Objective:** This study was designed to evaluate which element of music might be the primary factor influencing exercise performance.

**Methodology:** Healthy volunteers (age = 22-57) (n = 10) performed an incremental cycle ergometer exercise test to define conventional exercise parameters, and 4 randomly ordered free range cycle ergometer training bouts. During each bout, the subject listened to an audio track of: 1) music, 2) the percussion track from the musical selection, 3) a metronome beat set at the same basic rhythm of the music, and 4) white noise. Exercise was performed on a cycle-ergometer equipped with a SRM Training System to record heart rate (HR), power output (W), cadence (RPM) and speed (MPH). RPE was also recorded. The subjects were instructed to ride as they normally would during a training session, with full control over the gears and cadence of the cycle-ergometer.

**Results:** Although there was evidence that some subjects clearly entrained with all three elements of beat there was no evidence of a systematic effect of any element of music (R² = 0.017), percussion (R² = 0.0034) or metronome (R² = 0.0007) driving power output, or any other exercise parameter. These results are different than two other studies from our laboratory and are unexplained at present.

**Conclusion:** The results of this study do not support the idea that music motivates listeners to exercise at a greater intensity.