Abstract ID: S201
Title: Patient Perceptions of Cardiac Rehabilitation within Veterans Health Administration (VHA) Facilities with High Verses Low Program Utilization
Track: Cardiac
Authors: Allsup, Kelly1,2; McIntosh, Nathalie3; McDannold, Sarah3,4; Fix, Gemmae M.4,5; Manning, Kenneth3; Schopfer, David W.6; Whooley, Mary, MD6; Charns, Martin P.3,4; Forman, Daniel E., MD1,2

Introduction: Cardiac rehabilitation (CR) has been established as one of 9 performance measures for patients with ischemic heart disease by the American College of Cardiology Foundation, the American Heart Association, and The American Medical Association Physician Consortium for Performance Improvement, indicating that CR should be considered part of standard of care. However, CR is severely underutilized, both nationally and within the VHA.

Purpose: To identify patient-level facilitators that impact enrollment and successful utilization of VHA CR programs.

Design: We used a qualitative study design to examine patients’ referrals to, and experiences with, CR. We sampled patients who had cardiac surgery, heart failure, and MI, as well patients who did not utilize VHA CR, or utilized VHA or non-VHA CR.

Methods: We conducted semi-structured interviews with Veterans from six VHA centers with on-site CR programs and similar hospital complexity characteristics including cardiology services: three had high and three had low CR utilization. Veterans were identified by their CR enrollment status from the VHA national database. Interviews were conducted with three Veteran patient groups: 6 had enrolled in on-site VHA CR, 5 had enrolled in Non-VA CR, and 5 had not enrolled in CR. Interviews were audio-recorded, transcribed and analyzed using an emergent, thematic approach based on tenets of grounded theory. We created site summaries for each facility.

Results: Summaries showed important differences in patient perception at high- and low-utilization sites. In high-utilization sites, patients consistently described their cardiologist or surgery staff members as having emphasized the importance of CR. High sites’ CR programs were described as being welcoming, flexible and accommodating to unique patient needs. Patients from low sites who attended CR said providers spoke little about CR; patients reported initiating questions regarding CR. In some cases patients pursued CR through non-VA care without help from their VA providers. Across all sites, patients who enrolled in CR attributed it to providers’ endorsement. Correspondingly, patients who did not enroll in CR could not recall being informed about CR. Several patients at high-utilization sites described distance as a potential barrier however this was offset by patients’ perceptions of CR importance. These perceptions were influenced by provider endorsement of CR.
Conclusions: Literature often implicates logistics (distance, cost, time) as an insurmountable barrier to CR utilization, however our findings suggest that these impediments can often be offset by providers emphasizing that CR is critical, and CR programs being accommodating to patient needs.
Introduction: Cholesterol treatment guidelines, updated in 2013, re-affirmed the importance of statin therapy for secondary prevention in patients with atherosclerotic cardiovascular disease (ASCVD). In addition, the guidelines recommended that high risk patients receive high intensity statin therapy (HIST), if tolerated, for secondary prevention of cardiovascular events.

Purpose: Determine statin treatment patterns in a large, multi-state sample of patients with ASCVD attending outpatient cardiac rehabilitation (CR).

Design: A cross-sectional study design was used for CR facilities participating in the Montana Outcomes Project (MOP).

Methods: Over a one-year time-period (October 2014 through September 2015), data were collected from 121 programs representing 18 states participating in the MOP. Beginning in October 2014, the MOP began collecting data on three yes/no variables related to statin therapy: 1) on statin therapy, 2) statin contraindication and 3) on HIST or HIST not tolerated. HIST was defined as atorvastatin 40-80 mg or rosuvastatin 20-40 mg. The inclusion criteria consisted of patients 18-75 years with an ASCVD diagnosis. Patients with heart failure, valve repair/replacement only or patients with other non-ASCVD diagnoses were excluded from the analysis. A total of 6,063 CR patients met the inclusion criteria and were included in the sample. Statistical analysis included Chi-square and ANOVA tests with p-value of <0.05 indicating statistical significance.

Results: Overall, 73% of the patients were male, predominately white (93%), non-Hispanic (97%), and had a mean age of 62.5 years. After excluding patients with a statin contraindication, 97% were on statin therapy. Men were slightly more likely to be receiving a statin compared to women (97.2% vs. 95.7%). Overall, almost 40% of CR patients were not treated to the 2013 guidelines (this includes: 36.7% who were treated on a lower intensity statin without HIST intolerance documented and 3% who were not on statin therapy). Men and non-whites were significantly more likely to be treated to guidelines compared to women (62.0% vs. 54.9%) and whites (65.9% vs. 59.7%), respectively. Among the three age categories, the youngest age group had the highest percentage treated to guideline recommendations and decreased steadily for the other two age categories: 18-45 years 67.4%, 46-65 years 63.6%, and 66-75 years 55.1%.

Conclusion: Statin therapy was widely used in this sample of CR patients with ASCVD. However, after excluding those with statin contraindications and HIST intolerance, almost 40% of the patients were not being treated to evidence-based cholesterol treatment recommendations.
Abstract ID: S203
Title: Cardiac Rehabilitation Enrollment and Outcomes in Patients with Chronic Heart Failure and Reduced Ejection Fraction
Track: Cardiac
Authors: Rengo, Jason L., MS¹; Savage, Patrick D., MS¹; Ades, Philip A., MD¹

Introduction: Medicare expanded cardiac rehabilitation (CR) coverage in 2014 to include patients with a diagnosis of chronic heart failure (CHF) with reduced ejection fraction (rEF). There has been little study of the number of patients that are eligible for and that enroll in CR.

Purpose: Examine enrollment data and CR-related outcomes for CHF patients following hospitalization or clinical referral.

Design: Prospective, observational.

Methods: The cohort included consecutive patients (N=81) identified in-hospital with CHF and rEF and patients (N=33) referred from outpatient cardiology clinic from 6/2014 to 8/2015. In-patients were identified through weekly automated electronic medical record reports capturing patients inside the CR catchment area with rEF (≤35%). Further chart review excluded patients with their most recent EF measures >35% or with another diagnosis that would qualify them for CR. For patients that participated in CR, outcome measures included body mass index (BMI), estimated METs (estMETs) derived from a symptom limited exercise tolerance test, self-reported physical function (Medical Outcome Survey [MOS] SF-36) and Patient Health Questionnaire (PHQ-9). Changes in outcome measures were assessed for individuals that enrolled in and completed CR. Statistical methods included paired and unpaired t-tests and Chi-square analysis. Statistical significance was set at p<0.05 and results are presented as mean±SD.

Results: Of 81 patients identified in-hospital, 43 were deemed inappropriate for CR due to significant comorbidities (end stage renal disease, hospice care, severe mobility disability etc) or unstable CHF; and 27 declined CR or were lost to follow-up. Consequently, 14% (11/81) of patients following an acute CHF exacerbation enrolled in CR. Thirty-three patients with a primary diagnosis of CHF were referred directly from our outpatient cardiology clinic. Ultimately, 44 (Female=16) CHF patients enrolled in CR during the study period. Mean age and BMI were 67±12 and 30.5±6.7, respectively. Baseline values for estMETs, MOS-SF-36 and PHQ-9 were as follows: 5.2±1.7, 56±26 and 6±6. Twenty-two patients completed CR, 15 discontinued for personal reasons and 7 dropped out for medical reasons. Mean number of CR sessions attended was 23±15. For individuals that completed CR, significant improvements were observed in estMETs (5.0±1.5 vs 6.1±2.1), MOS-SF-36 (52±24 vs 68±23) and PHQ-9 (5±5 vs 3±3) (all, p<0.05). No differences were noted between clinic or hospital patients across all measures.

Conclusions: Despite systematic in-hospital screening, only 14% of eligible CHF patients following hospitalization enroll in CR. Focusing on outpatient clinical referrals and creating automated hospital referrals may be helpful in improving CR enrollment. For CHF patient’s attending CR, participation results in improved estMETs and self-reported measures of physical function and depressive symptoms.
Abstract ID: S204
Title: Patient Characteristics Predictive of Failure to Complete a Cardiac Rehabilitation Program
Track: Cardiac
Authors: Savage, Patrick D., MS, FAACVPR \textsuperscript{1}; Gaalema, Diann, PhD \textsuperscript{1}; Rengo, Jason L., MS \textsuperscript{1}; Cutler, Alex Y., BA \textsuperscript{1}; Elliott, Rebecca J., BS \textsuperscript{1}; Priest, Jeffrey S., PhD \textsuperscript{1}; Higgins, Stephen T., PhD \textsuperscript{1}; Ades, Philip A., MD \textsuperscript{1}

Introduction: Observational studies have demonstrated that there is a dose-response effect of cardiac rehabilitation. Unfortunately, rates for adherence and completion of CR are suboptimal with many individuals not completing the recommended course.

Purpose: In this study we examined associations between selected clinical and demographic patient characteristics and completion of CR.

Design: Prospective, observational

Methods: A prospectively collected clinical database was analyzed to test the associations between participant characteristics at CR intake and number of CR sessions completed. Completion of the CR program was defined as attending \geq 30 of 36 possible sessions. Socioeconomic status (SES), smoking status, age, sex, diagnosis (surgical vs. non-surgical), fitness, Body Mass Index, medical comorbidities, and depression scores were examined as covariates. Multiple regression and classification and regression tree (CART) modeling was used to examine associations between demographic and clinical participant characteristics at CR intake and number of sessions completed.

Results: The cohort (N=1658) had a median age of 64, was 27% female, and was 35% surgical patients. Current smoking at entry to CR was reported by 11% of patients and 21% were considered lower-SES. Completion rates differed significantly by age, smoking status and SES. While completion rate, overall, was 38%, only 23% of low-SES patients and 15% of current smokers attended \geq 30 sessions. Age (OR 1.33, CI 1.20-1.46 for each increase in age by 10 years), surgical diagnosis (OR 1.33, CI 1.07-1.65), lower-SES (OR 0.58, CI 0.43-0.77) and current smoking (OR 0.41 CI 0.27-0.62) predicted CR completion. The CART analysis identified age followed by smoking status, SES, and qualifying diagnosis (surgical vs. non-surgical) as the strongest predictors of program completion.

Conclusions: Younger age, self-reported current smoking, and lower-SES are robust predictors of non-completion of CR. Younger individuals, especially those who report smoking or financial challenges at CR intake, may require additional support to complete CR programs. Perhaps, interventions targeting smoking cessation may result in enhanced uptake for individuals at increased risk of not completing CR.
Abstract ID: S205
Title: Impact of an Individualized Patient Self-Monitoring Tool of Scheduled Cardiac Rehabilitation Visits on Attendance
Track: Cardiac
Authors: Saval, Matthew A., MS¹; Kerrigan, Dennis J., PhD¹; Harbac, Roxanne M., MS¹; Reasons, Lisa M.¹; Aldred, Heather E., PhD¹; Ehrman, Jonathan K., PhD¹; Keteyian, Steven J., PhD¹
Institutions: 1. Henry Ford Hospital, Detroit, Michigan, United States.

Introduction: The average national number of CR sessions attended by the Medicare population is 24±12 sessions (Suaya, JACC 2009), well below the allowed limit of 36. Unpublished data from our program indicates average completed sessions was 20±11 in the year proceeding this project. Therefore, strategies are needed to increase the number of CR sessions attended. We theorized that a patient self-monitoring tool (SMT) may help increase patient attendance.

Purpose: Describe the effects of an exploratory quality initiative project on 1) the total number of CR sessions attended, and 2) the number of days needed to complete 12 and 24 CR sessions.

Significance: Increased attendance would minimize staff down time and may optimize patient risk reduction.

Design: The SMT provided patients a personalized checklist of every scheduled CR session, and enabled independent tracking of attendance, exercise workload, and body weight. It was given at the first CR session to every other of 36 consecutive patients from September through October 2015. Patients who did not receive the tool instead received a generic calendar of all scheduled medical appointments, and served as a comparison group. Project location was Detroit, MI.

Methods: Eighteen SMT (age 62.1±6.7 years, 78% black race, 39% female, BMI 33.0±5.8), and 18 calendar patients (age 56.2±13.8 years, 78% black race, 56% female, BMI 35.0±9.6) were used in the project. Independent t test was performed to assess for differences between groups.

Results: The SMT and calendar patients completed 447 and 387 total sessions, and mean attendance was 24.8±12.3 and 21.5±11.4 sessions, respectively (p=0.41). Self-monitoring tool and calendar patients completed 12 sessions in 31.0±6.2 (n=15) and 34.9±9.4 (n=15) days (p=0.19); and 24 sessions in 65.7±8.0 (n=10) and 77.6±20.1 (n=9) days (p=0.10), respectively.

Conclusions: There was a trend toward a reduced number of days to complete 24 CR sessions (11.9 on average) in the SMT group. There was a non-significant greater number of CR sessions attended (60 in total) and lower number of days required to complete 12 CR sessions (3.9 on average) in the SMT group. This quality initiative was not appropriately powered. A power analysis using this preliminary data indicates that approximately100 patients would have been needed to show significance.

Implications: Given the financial, efficiency, and clinical ramifications associated with greater attendance among patients in CR, further research using a randomized design and involving a sufficient number of patients to yield adequate statistical power is warranted.
Abstract ID: S206
Title: A Long Term Follow-Up Study on Mortality and Morbidity Rates for Patients Who Participated in Outpatient Cardiac Rehabilitation: A Comparative Study
Track: Cardiac
Authors: Graham, Helen L., PhD, RN-C, CNS, FAACVPR²; Lee, Haek, MD¹; Lac, Andrew, MD²; Sanderson, Bonnie, RN, PhD, MAACVPR³.
Institutions: 1. University of Colorado, Colorado Springs, Colorado, United States. 2. University of Massachusetts, Boston, Massachusetts, United States. 3. Auburn University, Auburn, Alabama, United States.

Introduction
Long-term outcome studies of CR programs are limited and results vary. Some studies show a reduction in mortality and morbidity however current evidence is needed.

Purpose
To analyze long-term effectiveness of CR participation in terms of mortality & morbidity; and determine patient characteristics associated with mortality.

Design
Single-site retrospective cohort study.

Methods
Two groups of cardiac patients were hospitalized for an MI and/or CABG in 2001-2003, one group enrolled in CR (53%), second group, Non-CR (47%) declined to participate. Both groups were measured ten years after the cardiac event. Sample characteristics (N=370), 97% Caucasians, 72% male and 28% female, marital status single (9%), married (61%), divorced (9%), widowed (21%) and average age 67.5 (SD = 9.4) years. CR participants attended an average of 20 (SD = 9.4) sessions. To collect data related to re-admission and mortality, a retrospective chart review of hospital EMR & state health department records was completed during 2016. Outcome measures included ER and inpatient re-admissions. If re-admitted, discharge diagnosis and length of stay were determined. Mortality was determined from death certificates (34% deceased). Statistical analysis included descriptive statistics, independent t-tests, chi-square, and binary logistic regression. Statistical significance was set at p<.05.

Results
The total number of subsequent readmissions for the CR group (M=1.9, SD 2.5) compared to the Non-CR group (M=1.7, SD 2.5) was not significantly different, t(208) = 0.62, ns. However, cardiac related readmission length of stay for Non-CR group (M = 1.9, SD = 3.6) was significantly higher than CR group (M = 0.3, SD = 1.4), t(209)= 4.62, p < .001. Also, Non-CR group revealed a greater proportion of deaths (47%) compared to CR group (23%), X²(1) = 24.24, p < .001. Binary logistic regression model of 4 predictors ascertained that higher likelihood of mortality was unrelated to gender (OR = 1.08, ns), but was significantly predicted by older age when event occurred (OR = 1.09, p < .001), and previous history of heart disease (OR = 1.66, p = .05). Even after accounting for these covariates, CR group had approximately 1/3 the odds ratio of dying (vs not dying) relative to the Non-CR group (OR = 0.32 p < .001). Predictors collectively explained a significant proportion of variance in mortality outcome, Nagelkerke R² = 30.6%, p < .001.

Conclusions
Data from this single-site cohort study indicates CR participation significantly decreases long-term all-cause mortality but does not decrease readmission rates.
Abstract ID: S207  
Title: Predictors of Enrollment into Maintenance Program in Women Completing Phase II Cardiac Rehabilitation  
Track: Cardiac  
Authors: Ganga, Harsha V.¹  
Institutions: 1. Brown University, Providence, Rhode Island, United States.

Introduction: Current duration of Phase II cardiac rehabilitation is not sufficient to sustain the benefits of CR in the long term. Enrollment of women in CR is inadequate. The predictors of enrollment of women into maintenance programs are unknown. Exploring factors predicting maintenance program enrollment in women is necessary to develop CR delivery models in this under-referred population.

Objective: We evaluated the predictors of enrollment of women into maintenance program in a large urban CR center from the year 2000 to 2014.

Methods: 1368 women completing 36-session structured Phase II CR sessions were included in this study. Data was abstracted in age, race, number of Phase II CR sessions attended, weight at the beginning and the end of CR, metabolic equivalents achieved at the end of CR, distance from CR, and SF-36 measurements (physical and mental scores) at the end of CR. Baseline characteristics were assessed using descriptive statistics. Multivariate analysis was performed with multiple logistic regression modeling.

Results: A total of 278 (20.3%) of the 1368 women completing Phase II CR enrolled into maintenance program. Mean age was 65 (±12) years. On multiple logistic regression, women with at least college education [Odds Ratio (OR) 1.5 95% confidence interval (CI) 1.07-2.02], living closer to the CR center [OR 2.30, 95% CI, 1.20-4.25], with anxiety [OR 1.60, 95% CI, 1.02-2.41], with CHF [OR 3.30, 95% CI, 1.18-7.76], attending more Phase II CR sessions [OR 1.07, 95% CI 1.04-1.10], with weight loss, [OR 1.04, 95% CI, 1.00-1.07] were more likely to enroll. Women exercising for longer duration [OR 0.94, 95% CI, 0.91-0.98] were less likely to enroll.

Conclusion: Higher education, living closer to CR, presence of anxiety and CHF, attending more Phase II CR sessions and weight loss during Phase II CR predict increased enrollment of women into maintenance program whereas increased exercise capacity predicts decreased enrollment.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P Value</th>
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<tr>
<td>College education</td>
<td>1.5</td>
<td>1.07-2.02</td>
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</tr>
<tr>
<td>Less than 15-minute distance</td>
<td>2.30</td>
<td>1.20-4.25</td>
<td>0.01</td>
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<tr>
<td>Anxiety</td>
<td>1.60</td>
<td>1.02-2.41</td>
<td>0.04</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>3.30</td>
<td>1.38-7.76</td>
<td>0.007</td>
</tr>
<tr>
<td>Weight loss during Phase II CR</td>
<td>1.04</td>
<td>1.00-1.07</td>
<td>0.02</td>
</tr>
<tr>
<td>Exercise duration</td>
<td>0.94</td>
<td>0.91-0.98</td>
<td>0.0001</td>
</tr>
<tr>
<td>Total Phase II sessions attended</td>
<td>1.07</td>
<td>1.04-1.10</td>
<td>0.0005</td>
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Abstract ID: S208
Title: Analyzing the distribution of Cardiac Rehabilitation programs in the US using Geographical Information Systems (GIS)
Track: Cardiac
Authors: Odhiambo, Lorriane A.1; Opoku-Agyeman, William, PhD2; Zullo, Melissa, PhD1; Dolansky, Mary, PhD3; Josephson, Rich, MD1
Institutions: 1. Kent State University College of Public Health, Kent, Ohio, United States; 2. University of Alabama, Birmingham, Alabama; 3. Case Western Reserve University, Cleveland, Ohio, United States; 4. University Hospitals Case Medical Center, Cleveland, Ohio, United States.

Introduction: Cardiovascular diseases contribute the highest mortality rates in the United States (US). Cardiac rehabilitation (CR) is a critical aspect of cardiovascular disease rehabilitation; however, patients may not have access due to financial or geographic constraints or programs may not have capacity to manage patients.

Purpose: The purpose of this study was to examine the distribution of CR programs in the US and to describe the density of programs per myocardial infarction (MI).

Design: This was a cross sectional study using Medicare data of Beneficiaries with MI in 2008 combined with address data from the American Hospital Directory of the 2,551 CR programs across the US and territories.

Methods: Two Geographical Information Systems (GIS) techniques, spatial data analysis and density point mapping were used to examine the distribution of CR programs and the density per MI to access whether patients have access and programs have capacity.

Results: The distribution showed a higher density of CR sites in the Midwest and Northeastern regions of the US, where a higher cluster of CR to patient ratio was greater. Some areas of the US lacked program availability and clusters of patients do not have access.

Conclusion: This is the first research to describe the locations of CR programs in the US and to demonstrate relationships between program location and number of MIs. Future research will explore the patient count of programs to determine capacity and will include other CR eligible cardiac diagnoses.
Abstract ID: S209
Title: Effect of Cardiac Rehabilitation on Functional Capacity in Left Ventricular Assist Device Patients: A Systematic Review and Meta-Analysis
Track: Cardiac
Authors: Haddad, Toufik Mahfood, MD; Saurav, Alok, MD; Azzouz, Muhammad, MD; Akinapelli, Abhilash, MBBS; Williams, Mark A., PhD; Alla, Venkata M., MD
Institutions: 1. Creighton University, Omaha, Nebraska, United States.

Introduction
Exercise-based cardiac rehabilitation (EBCR) has been demonstrated to improve functional capacity in congestive heart failure (CHF) patients through improvement in peak oxygen consumption (VO₂) and 6-minute walk distance (6MWD). However, there are limited data on the impact of EBCR in patients with left ventricular assist devices (LVAD) despite the routine prescription of EBCR in pivotal LVAD trials.

Purpose
To evaluate the effect of cardiac rehabilitation on functional capacity in LVAD patients.

Design
We conducted a systematic review and meta-analysis to evaluate the impact of EBCR on measures of functional capacity in LVAD recipients including peak VO₂ and 6MWD.

Methods
We searched PubMed, Cochrane Library, Web of Science, and CINAHL for eligible studies reporting use of EBCR in LVAD patients through Feb 15th 2016 using the following keywords: heart assist device, left ventricular assist device, ventricular assist device, assistive device & cardiac rehabilitation. Data from selected studies were extracted and a meta-analysis of randomized trials was performed comparing EBCR versus standard therapy (ST) using random effects model with DerSimonian Liard weighting. Analysis employed weighted mean difference (WMD) as the effect size and intention-to-treat (ITT) principle. Study quality, publication bias and heterogeneity were assessed.

Results
Six trials with a total of 183 patients (EBCR: 125; control: 58) were identified. Mean age was 50.8 years (EBCR: 50.9 yrs. Control: 50.8 yrs.) and 82.5% were males. Rehabilitation started 10 days to 10 months post-LVAD implantation and lasted from 1 to 18 months. Median follow-up varied from 6 to 10 weeks. EBCR was associated with improved peak VO₂ in all but 2 trials (n=18). Quantitative analysis was done on 3 randomized studies (EBCR: 39, control: 22). EBCR was associated with significantly greater peak VO₂ (WMD: 3.0; 95% CI: 0.64-5.35, P=0.01). Similarly, 6MWD showed significantly greater improvement in the EBCR group compared to control group (WMD: 60.06 meters; 95% CI: 22.61-97.50, P=0.002). No significant heterogeneity was observed among the included trials. Exclusion sensitivity and per-protocol analysis demonstrated results consistent with ITT analysis.

Conclusion
Our meta-analysis shows that exercise-based cardiac rehabilitation is associated with greater improvement in functional capacity as compared to control as reflected by improved peak VO2 uptake and 6MWD. However given the small number of patients, further research into the clinical impact of exercise-based cardiac rehabilitation in LVAD patients is necessary.
Abstract ID: S210  
**Title:** Exercise Training Intensity based on a Maximal Exercise Test is Associated with Greater Gains in Functional Capacity during Cardiac Rehabilitation  
**Track:** Cardiac  
**Authors:** Schley, Allison N.¹; Brawner, Clinton A., MS¹; Keteyian, Steven J., PhD¹  
**Institutions:** 1. Division of Cardiovascular Medicine, Henry Ford Hospital, Detroit, MI, United States.

**Introduction:** Among patients in cardiac rehabilitation (CR), exercise capacity (EC) is inversely associated with survival. Improvements in EC are, in part, based on exercise intensity. While maximal exercise testing is recommended to guide exercise intensity in patients who participate in CR, there remains controversy regarding the need to perform these tests. As a result, many programs guide exercise intensity without exercise test data using ratings of perceived exertion (RPE) alone.

**Purpose:** Compare gains in EC during CR, based on exercise intensity titrated by RPE alone vs. a target heart rate range (THRR) based on results from a maximal exercise test.

**Design:** Retrospective cohort study.

**Methods:** Patients who completed ≥9 CR sessions with Henry Ford Hospital between 2013 and 2015 were identified from an outcomes database. Patients were grouped based on whether exercise intensity was guided by a THRR from an exercise test (THRR group) or by RPE for patients without a test (RPE group). Using metabolic equivalents of task (METs), calculated from treadmill workloads at the start and exit from CR, absolute and % change in METs during CR was calculated by group. Adjusted change was calculated using multiple linear regression, including sex, age, METs at start of CR, and number of CR visits.

**Results:** Among 809 patients (age= 62±11 y; 35% women) with complete exercise training MET data, 308 (38%) were prescribed a THRR based on an exercise test. Median CR visits was 24 for both groups. There was a significant increase in METs during CR in both the THRR (1.8±1.4, 61±45%, p<0.001) and the RPE groups (1.2±1.1, 46±40%, p<0.001). The increase was significantly greater in the THRR vs. the RPE group (p<0.001). In adjusted analyses, change in METs were 1.7±0.4 (59±11%) and 1.1±0.3 (45±11%) among the THRR and RPE groups, respectively (p<0.001 between groups).

**Conclusions:** CR improved EC regardless of whether intensity was guided by a THRR from an exercise test or RPE without an exercise test. However, improvement was 50% (unadjusted) to 55% (adjusted) greater among patients who were provided a THRR. These data highlight the importance of guiding exercise intensity based on a maximal exercise test for select patients participating in CR. Future work is needed to confirm these findings, to identify those patients in whom exercise testing is most beneficial, and to determine if exercise intensity guided by a THRR from an exercise test is associated with better survival.
Abstract ID: S211
Title: Baseline Lipid Values in Patients Referred for Cardiac Rehabilitation
Track: Cardiac
Authors: Banathy, Alexandra, BA; Lin, Jonathan, BS; Winters, Carla, RN; Andersen, Lars, BA; Hudson, Cindy, MSN, RN, NE-BC; Testa, Heidi, BSN, CCRP; Reardon, Joy, RNBC, BSN, FAACVPR; Lehman, Erik, MS; Alagona, Peter Jr., MD.
Institutions: 1. Pennsylvania State University College of Medicine, Hershey, Pennsylvania, United States. 2. Lancaster General Hospital, Lancaster, Pennsylvania, United States. 3. Pinnacle Health System, Harrisburg, Pennsylvania, United States.

Introduction: LDL-C, HDL-C, and non-HDL-C are the most common lipid measurements utilized in cardiovascular disease (CVD) risk assessment with LDL-C the primary measure. The Cardiac Rehabilitation (CR) population is a sub-group of patients with very-high risk of recurrent CVD events.

Significance: Insights into the baseline status of this population may lead to improved risk assessment.

Purpose: This study evaluates which of the 3 lipid measures were better predictors of CVD in patients enrolled in CR.

Design: Baseline lipid measurements from subjects enrolled in CR between 1/1/2012 and 8/31/2015 aged 26-89 with known CVD were retrospectively obtained and analyzed.

Methods: Off-treatment lipid values were analyzed to determine the most powerful predictor(s) of CVD. Patients were age and sex matched to appropriate controls with no evidence of CVD and not on statin therapy. Statistical analysis included a logistical regression model to compare each lipid value for association with CVD as an outcome.

Results: Retrospective chart review identified 330 patients with lipid measures available within 5yrs prior to a CVD diagnosis that resulted in CR enrollment. 253 (76.7%) male and 77 (23.3%) females, average age of 61.7 (±11.32) were included. The mean and SD (±) lipid values for the CR population and controls respectively were TC 189.2mg/dL (47.1); 183.9mg/dL (37.4), LDL-C 118.7mg/dL (40.6); 112.5mg/dL (31.3), HDL-C 39.5mg/dL (11.1); 45.1mg/dL (14.4), and non-HDL-C 149.2mg/dL (45.2); 138.8mg/dL (35.2). The c-statistic was the strongest measure for each lipid value and CVD risk. Logistical regression c-statistic and p values respectively for each value: TC c-statistic= 0.520; p=.11, LDL-C 0.542; p=.03, HDL-C 0.621; .0001, and non-HDL-C 0.567; 001. Subgroup analysis of men and women respectively for each lipid variable were TC p=.24; p=.21, LDL-C p=.08; p=.18, HDL-C p<.0001; p<.0017, and non-HDL-C p=.01; p=.04. In 8 patients, elevated TG >400mg/dL prevented accurate calculation of LDL-C.

Conclusions: In this group of CR patients, baseline LDL-C, HDL-C, and non-HDL-C are all independently associated with CVD risk with no difference between men and women. LDL-C and non-HDL-C are similar predictors with non-HDL-C being slightly better based on the c-statistic. Decreased HDL-C was the strongest predictor per 5mg/dL.

Implications: The data provide modest support for using non-HDL-C vs LDL-C in CVD risk assessment in high-risk groups. TG do not affect non-HDL-C and can be calculated and utilized non-fasting in all patients. More comprehensive evaluation of all risk factors, traditional and novel, would improve the accuracy of individual risk assessment.
Abstract ID: S212
Title: Education attainment and achieved treadmill workload: differences in cardiac rehabilitation participants
Track: Cardiac
Authors: Boehlke, Nathan, MS, ACSM-RCEP
Institution: 1. Porter Adventist Hospital, Denver, Colorado, United States.

Introduction: Educational attainment and maximal metabolic equivalencies (METs) are strong predictors of health-related behaviors. Studies suggest educational accomplishment is an important predictor in CR participation rates.

Purpose: The study aimed to compare age, gender, attended sessions, and METs of college graduate (CG) and non-college graduate (NCG) Phase II CR participants.

Design: A retrospective comparative design compared 182 participants completing ≥ 12 sessions between November 2012 and September 2015.

Methods: A Patient Education Assessment Tool, a 9-item educational level questionnaire, was administered at initial CR session. Medical record review collected gender, age, METs, and education. Education was compared to program end METs by age, gender and number of sessions. T-tests and Ordinary Least Squares regression determined statistical significance.

Results: 143 males (mean = 64.7 years) and 39 females (mean = 70.7 years) completed an average of 26 sessions. 114 participants were CG (mean = 65.8 years) and 68 NCG (mean = 66.2 years). CGs achieved significantly higher mean METs than NCGs (6.9 vs 6.1 mean METs; t=-2.472; p=0.0145). There is a significant interaction between age and education adjusting for gender. In the adjusted analysis, METs significantly varied with education and age (F = 13.88, p < 0.001). MET levels were significantly lower in NCGs aged > 65 years (t = -2.41, p = 0.017). This finding is significant for men only (t = 3.03, p = 0.003).

There was no significant difference between CGs and NCGs in session attendance (t=-0.1209; p=0.903). Significant associations existed between mean METs and age. For every one year increase in age, percent of average METs completed declines 11%, holding education and gender constant (p < 0.001 t = -8.43).

Conclusions: CGs achieve higher METs than NCGs. Education achievement did not affect sessions attended. Knowledge of education differences can help CR staff develop strategies to meet needs of participants during rehabilitation. Further research is needed to determine effects of other social and economic variables.
Abstract ID: S213
Title: Exploring a new individualized patient exercise tolerance assessment for cardiac rehabilitation patients
Track: Cardiac
Authors: Craig Clemens, MA, RCEP1; Nanette S. Malgesini, MSN, RN, FNP-C1; Vivian Low, MPH, BSN, RN-BC, FPCNA1
Institutions: 1. El Camino Hospital, Mountain View, California, United States.

Introduction: The six-minute walk test (6MWT) assesses exercise tolerance in Cardiac Rehabilitation, but has shortcomings among some patients. The study goal was to evaluate the Recumbent Cross Trainer Test (RCTT) as an alternative.

Purpose: The study compared metabolic equivalents (METs) and perceived exertion between RCTT and 6MWT among patients of low, medium, and high functional ability at the start of a cardiac rehabilitation program.

Significance: The 6MWT is frequently used for assessing exercise tolerance to develop an exercise prescription. The 6MWT falls short when patients are low functioning and alternately, when they are high functioning.

Design: This study used equivalence testing in a cross sectional study of RCTT compared to the standard, 6MWT, with each participant serving as his/her own control. The study question was: is there equivalence in METs and perceived exertion between the RCTT and 6MWT, among patients of low, medium, and high functional ability?

Methods: Participants providing informed consent at a community hospital performed both the 6MWT and a self-paced, six-minute RCTT prior to starting cardiac rehabilitation. They were categorized as low, moderate or high functioning based on 6MWT results. METs and Rating of Perceived Exertion (RPE) were measured during each test as outcomes. Paired t-tests evaluated the difference between tests within each subject.

Results: Forty-six patients participated (low functioning n=6; moderate n=32; high n=8). In both low and moderate functioning patients, METS were lower, although not deemed clinically significant, and RPE was higher during the RCTT test compared to the 6MWT; these findings were statistically significant only in the moderate functioning group (p=.005). In the high functioning group, both the METS and the RPE were higher during the RCTT compared to the 6MWT, a significant difference for RPE (p=.037).

Conclusions: Despite small sample sizes, the observations of slightly lower METs and higher perceived exertion suggest that RCTT may be a safe alternative, in particular for patients with low functional ability. The higher METs and higher perceived exertion with RCTT in the high functioning group suggest that the RCTT may both be more appropriate and more accurate as an assessment of tolerance in those with a more active lifestyle prior to their cardiac event.

Implications: These findings suggest a safer test environment for patients with low function and physical instability. High functioning patients were not limited in performance. Additional studies may be conducted with a larger sample size to validate the findings of those groups.
Abstract ID: S214
Title: Pulmonary Rehabilitation in Lung and Pleural Cancer Patients: Preliminary Report.
Track: Pulmonary
Authors: Contreras Delgado, Alma Nelly1; Flores Echeverria, Monica Ivette1; Romero Bielma, Elizabeth1; Baños Mejía, Omar1; Galicia Amor, Susana1
Institutions: 1. Instituto Nacional de Enfermedades Respiratorias, Mexico City, Mexico DF, Mexico.

Introduction: Lung cancer in Mexico is the main cause of death in men and fifth in women. Initially the course is asymptomatic, however, cough, dyspnea or chest pain must be considered. The aim of Pulmonary Rehabilitation (PR) is to enhance patient care by controlling symptoms in the physical, psychological and social aspects, as much in pre as in postoperative time, if necessary, and to achieve a meaningful and sustainable behavior change.

Purpose: Growing evidence supports the use of PR in lung cancer. Nevertheless, there are gaps in knowledge regarding advantages of pulmonary rehabilitation in Mexico. The present study strengthens the research of the Program.

Design: Prospective, longitudinal and descriptive study.

Methods: Inclusion criteria were patients diagnosed with lung or pleura cancer, with or without chemotherapy, radiotherapy or lung resection. As part of the program, a first evaluation was made which consisted of a six minute-walk test (6MWT), SF-36 and St George questionnaires (SGQ) and it was applied the hospital anxiety and depression scale (HAD). Following the initial evaluation, patients started chest physiotherapy (CPT) including diaphragmatic breathing (DB), pursed lip breathing and energy conservation techniques, 3 sessions minimum. If airway clearance was impaired, postural drainage, manual vibration and cough techniques were taught. Then physical conditioning began, 10 sessions minimum prior surgery. During postoperative, patient resumed CPT and 20 sessions of exercise. Eventually, the 6MWT and questionnaires above mentioned were applied. Statistics were performed later.

Results: 34 patients were included, only 10 completed the program. Initial 6MWT was 423±76m and final 505±82.5m (increasing 82m). SGQ improved 6 points in the activity component. SF-36 enhanced in physical role 28%, vitality 12% and general health 7%. HAD scale had a higher score but with no statistical significance. The finding about the causes of abandonment: 10 cases with early postoperative discharge, 9 were foreign and returned home, 3 became significantly worse, 1 could not complete it because of economics barriers and 1 died.

Conclusions: PR shows promise as a therapeutic intervention in the management of lung cancer regardless type of treatment. Its implementation is not the limiting factor but the late of referral or limited access because of unfamiliarity of benefits. Further strategies are needed to promote a long-term adherence and avoid desertion, as well as to make aware the specialists involved.
Abstract ID: S215
Title: Safety of Medically Supervised Exercise in Elderly Patients in a Cardiac Rehabilitation Center Compared with Home Based Prescription of Non Supervised Exercise. Comparison Between Two Periods 1987-2000 and 2001-2013
Track: Cardiac
Authors: Fernandez de la Vega Romo, Pedro, MD, FAACVPR
Institutions: 1. Médica Sur, Mexico City, Mexico DF, Mexico

Introduction: Previous studies using pooled data from multiple centers have documents relative low rates of Cardiac Arrest and Myocardial infarction (MI) during exercise training through Cardiac Rehabilitation. However, a methodological error can occur via meta-analysis.


Methods: A total of 21000 patients exercising 4,832,950 hours over 26 years in two periods (1987-2000), 7,500 patients and (2001-2013) 13,500 patients were assessed for medical complications, and 9,374 patients were assessed with a Home based prescription of non-supervised exercise. Statistical analysis: Baseline characteristics were compared using the unpaired t test and the x2 statistics. All statistical tests with a p value < .05 were considered significant.

Results: The mean age was 57+14 years for phase I (1987-2000) and 58+14 years between 2001 and 2013. Phase II 64+11 years (1987-2000) and 66+11 years phase II (2001-2013); and 69+12 years phase III (1087-2000) and 72+14 years between 2001-2013, phase III. Men (14386 patients) made up 69% of the population; 24% were post MI, 16% were post CABS, 22% were post PTCA; 45% were referred following: new onset angina (25%), congestive heart failure 14%, and valvular heart disease (6%). Over all 45% were referred for secondary prevention; 55% for primary prevention and 43% of this population was referred for home based prescription non supervised exercise with 2,641,441 patients/hour exercise. Over all 20 major cardiovascular complications occurred associated with training (20 non-fatal MI) without any fatalities: 4 of the 20 complications occurred associated with training in the CR center (pt/hr/event ratio .0000018) and 16 patients experienced the same cardiac event during unsupervised training at home (pt/hr/event ratio: .000006). Four myocardial infarctions occurred during 2,128,509 supervised training hours. We did not have any major cardiovascular complications such as cardiac arrest.

Conclusion: These results demonstrate a low frequency of mayor cardiovascular complications in a single CR Center overall 26 year period ending in December 2013. Patients exercising at home and post PTCA has increased 42% and 40% in the second period (2001-2013) respectively. Medically supervised exercise continues to have a low major cardiovascular complication rate.
Abstract ID: S216
Title: The Improvement of Exercise Capacity Changes and Incidence of Major Coronary Events and Cardiovascular Mortality at Long Term Follow Up in Older Patients in Home Versus Center Based Cardiac Rehabilitation
Track: Cardiac
Authors: Fernández de la Vega Romo, Pedro, MD, FAACVPR
Institutions: 1. Médića Sur, Mexico City, Mexico DF, Mexico

Introduction: Participation in either center or home based cardiac rehabilitation (CR) can improve exercise capacity. The sustainability of this improvement following completion of the CR program and 5 years follow up could explain a reduction in coronary events and mortality on long term follow-up.

Purpose: The purpose of this study was to compare the immediate and 1.5 year effectiveness of center versus home based CR on exercise capacity and coronary events in old cardiac patients who were given the choice of participating in a center-based or home-based CR program.

Methods: This was a retrospective study which relied on the data base from a large multidisciplinary CR program. A sample of 280 cardiac patients participated either in center based (n= 140) or home based (n=140) CR. Participants underwent exercise training at baseline, after 48 weeks of CR and again 18 months after completion of the CR programs. Statistical analysis: Baseline characteristics were compared between the 2 groups using the unpaired t test and the x2 statistics. All statistical tests with a p value < .05 were considered significant.

Results: Following CR exercise capacity (ie, peak metabolic equivalents (Mets)) increased significantly in both groups (p< 0.05). From post CR to the 1 1/2 year of follow-up, exercise capacity remained unchanged in home based CR participants (p<0.185), whereas the center based CR group demonstrated a decline in exercise capacity (p< .05). Major coronary events (MACE) and long term follow-up mortality were significantly lower in the CR group (p<.05).

Conclusions: Although at the 1.5 year follow-up exercise capacity decreased in the center based group, the observed decline did not seem to be clinically significant. The present findings indicate that patients into the delivery model (center-vs home-based) used for their CR program, they were relatively successful in retaining the improvement in exercise capacity 18 months post CR irrespective of the exact location for their exercise training. MACE and CV mortality decreased on long term follow-up in the CR Center trained group (p<.05).
Abstract ID: S217
Title: How Does DHMC Compare Nationally for Cardiac Rehabilitation Referral Rates Post PCI and Cardiothoracic Surgery?
Track: Cardiac
Authors: Frechette, Kristin M., BA, RN\textsuperscript{1}; Conley, Sheila N., BSN, RN\textsuperscript{1}; Welch, Terrence D. MD\textsuperscript{1}
Institutions: \textsuperscript{1}. Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire, United States.

\textbf{Introduction:} In 2014, the Centers for Medicare and Medicaid Services (CMS) instituted a new performance measure that patients with Acute Myocardial Infarction (AMI) or Percutaneous Intervention (PCI) receive referrals to Cardiac Rehabilitation programs after discharge from hospital.\textsuperscript{1}

\textbf{Purpose:} This study was done to confirm our institution’s procedure for managing cardiac rehabilitation referrals was meeting or exceeding the national average.

\textbf{Significance:} Referral rates for cardiac rehab are tracked by CMS and CathPCI Registry\textsuperscript{®} in the National Cardiovascular Data Registry (NCDR\textsuperscript{®}).\textsuperscript{2} By analyzing our data, we determined where we needed to make improvements in our referral process.

\textbf{Background:} Dartmouth Hitchcock Medical Center (DHMC) in Lebanon, New Hampshire, is a tertiary academic medical center with well-established inpatient and outpatient cardiac rehab programs. A full time cardiac rehab RN works with Cardiovascular medicine teams and patients, determining if outpatient referral is appropriate and facilitates orders.

\textbf{Design:} Retrospective review of post PCI and post Cardiothoracic Surgery patients treated at DHMC January – June 2015 was assessed for appropriate Cardiac Rehab referrals.

710 patients identified as appropriate for review by cardiac rehab nurse.

Proof of referral was documentation in EMR that referral was sent to outpatient program or reason why referral was not made.

- No referral made
- Referral placed
- Ineligible based on:
  - patient oriented factors: e.g., patient refusal*
  - medical factors: e.g., dementia, unable to exercise
  - healthcare system factors: e.g., financial barriers, proximity to program\textsuperscript{3}.

* The 2010 AACVPR/AAC/AHA Performance measures for Cardiac Rehabilitation services updated the statement that patient refusal should no longer be considered a reason not to provide referral.\textsuperscript{4} However, when patients decline based on informed decision, they do not give consent to send medical information/referral= deemed ineligible.

\textbf{Results:}
Post PCI Referral Rates:
DHMC = 91.5%
National = 61.3\%\textsuperscript{2}

98\% eligible post PCI and Cardiothoracic patients evaluated by cardiac rehab RN

- 543 (76\%) eligible for referral
- 167 (24\%) ineligible
Of the eligible:
- 12 (2%) missed
- 531 (98%) referred
  91 (17%) referred to DHMC’s program, 80 (88%) attended at least 1 session

Conclusions:
- DHMC has excellent cardiac rehab referral rates
- Missed patients either discharged through Same Day program post PCI or from other services
- Weekend and holiday discharges are successfully managed

Implications:
- Results support maintaining current processes for identifying and creating timely cardiac rehab referrals
- 440 patients referred back to community for cardiac rehab


2. NCDR registry, CathPCI Registry®


Abstract ID: S218
Title: Guideline-driven High-intensity Statin Dose Achievement in Cardiac Rehabilitation Patients
Track: Cardiac
Authors: Lin, Jonathan, BS¹; Banathy, Alexandra, BA¹; Winters, Carla, RN²; Andersen, Lars, BA²; Hudson, Cindy, MSN, RN, NE-BC²; Testa, Heidi, BSN, CCRP³; Reardon, Joy, RNBC, BSN, FAACVP²; Iskandarani, Khaled, MPH¹; Alagona Jr., Peter, MD¹
Institutions: 1. Pennsylvania State University College of Medicine, Hershey, Pennsylvania, United States. 2. Lancaster General Hospital, Lancaster, Pennsylvania, United States. 3. Pinnacle Health System, Harrisburg, Pennsylvania, United States.

Introduction: The 2013 American College of Cardiology/American Heart Association (ACC/AHA) Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk recommends high-intensity statin therapy for clinical atherosclerotic cardiovascular disease (ASCVD) patients age ≤75. Despite this recommendation, high-intensity statin remains underutilized post-hospitalization of ASCVD patients. Lipid management, a core component of Cardiac Rehabilitation (CR), includes documenting fasting lipid values, assessing treatment and monitoring compliance, however effectiveness of CR in lipid management and guideline adherence is unknown.

Purpose: The purpose of this study is to determine if CR participation affects guideline achievement for statin use.

Design: This multi-center retrospective study evaluated statin utilization pre- and post-CR between 1/1/2014 and 8/31/2015.

Methods: Records for patients with known coronary artery disease who completed 18 or more CR sessions were reviewed for drug and dose prior to and after CR as well as any documented evidence of statin intolerance. Statin intensity was stratified according to the 2013 ACC/AHA guidelines. The McNemar’s chi-square test was used for statistical analysis.

Results: Of the total 471 subjects, 76% were male with mean age and SD 66.0±10.8 with age range 32 to 89. Subjects age ≤75 (n=378) showed statistically significant increase (p=0.001) in high-intensity statin use post-CR from 56.1% to 61.1%. Males demonstrated significant increase in high-intensity statin use (p=0.002) while females showed no significant change. Of the 147 subjects age ≤75 not on high-intensity statins post-CR, only 21 had history of statin intolerance. Of the subjects age >75 (n=93), 91% were already on high or moderate-intensity statins and showed no significant change.

Conclusions: According to our results, CR completion in subjects age ≤75 increases high-intensity statin use. However, despite a statistical significance, high-intensity statin use in this cohort increased only by 5% post-CR and 33% of subjects neither received high-intensity statin post-CR nor had documented statin intolerance. The majority of subjects age >75 were already on moderate-high intensity statins at CR enrollment and did not demonstrate significant changes. The CR population has a high risk of recurrent ASCVD events. These patients receive repetitive counseling and interact with healthcare professionals multiple times a week during CR. The updated 2013 treatment recommendations simplified statin use, yet substantial data continue to reveal that guideline achievement even post-CR remains limited.

Implications: CR needs to identify barriers to improve guideline adherence and increase utilization of high-intensity statin post-CR.
Abstract ID: S219
Title: The Long-term Effects of 16 Weeks Aerobic Exercise Program with Nutritional Intervention in Primary Hypertensive and Overweight/obese Adults: Preliminary Results of 6 Months Follow-up of the EXERDIET-HTA Controlled Trial.
Track: Cardiac
Authors: Maldonado-Martín, Sara

Introduction: Both exercise training and diet are recommended to prevent and control primary hypertension (HTN) and overweight/obesity. However, there is no agreement about the optimal dose of intensity, volume and type of exercise, neither the knowledge regarding the long-term effect after intervention period.

Purpose: To investigate the effect of different 16-week aerobic exercise programs with nutritional intervention on mean arterial blood pressure (MAP), body mass index (BMI) and cardiorespiratory fitness (VO2peak and METpeak) in primary hypertensive and overweight/obese adults and during an extended unsupervised period of six months.

Design: Randomized controlled trial. After baseline measurements (T0, n=104) participants were allocated to one of the four intervention groups for 16 weeks (T1, n=102), as well as after six months of unsupervised period with only physical activity and dietary recommendations (T2, n=88).

Methods: Overweight/obese participants (53.3±7.9 yrs old) diagnosed with HTN performed assessments to evaluate MAP, BMI and VO2peak and METpeak at T0, T1 and T2. All participants received an energy restricted diet and were randomized to attention control group (AC, diet and physical activity recommendations) or three exercise groups (diet and supervised training 2 days/week): moderate continuous and high volume (MCT) group, high-volume and high-intensity interval training (HV-HIIT) group, and low-volume and high-intensity interval training (LV-HIIT) group. An analysis of covariance (ANCOVA) was performed to compare training and the six-month unsupervised period effects among the groups.

Results: At T1 all groups decreased BMI (p<0.001) and MAP (p<0.05), and increased VO2peak and METpeak (p<0.001) (D%VO2peak, AC=15%, MCT=22.4%, HV-HIIT=28.2%, LV-HIIT=30.3%) when compared to T0. At T2, meanwhile VO2peak and METpeak were maintained for AC and MCT, decreases (p<0.001) were observed in HIIT groups (D%VO2peak, HV-HIIT=-9.4%, LV-HIIT=-14.8%) when compared to T1. Comparing T2 with baseline: for all groups BMI presented lower values (p<0.001), whereas MAP values were similar (p>0.05). In three of the groups VO2peak was higher (p<0.05) (D%, AC=12%, MCT=12.5%, HV-HIIT=16.1%), but not for LV-HIIT. Changes in METpeak were higher (p<0.05) only in high volume groups (D%, MCT=9.2%, HV-HIIT=15.6%) and only HV-HIIT demonstrated one MET increase from baseline to six-month unsupervised period.

Conclusions: Combined treatment (diet+exercise) exerted positive effects on reducing BMI and MAP and increasing cardiorespiratory fitness, and many of the changes persisted for six months follow-up with some attenuation of the benefits. Low-volume HIIT may be a practical time-efficient strategy to improve cardiorespiratory fitness (i.e. “less is more”). However, HV-HIIT seems to have a higher long-term cardioprotective-effect (i.e. “the higher and the more the better.”
Introduction: Lack of sleep or sleep of poor quality has been linked to cardiovascular morbidity in epidemiological studies.

Purpose: The primary objective of this study was to determine if there was a significant difference between the sleep quality of cardiac rehabilitation patients exposed to the aroma of an essential oil mixture and those not so exposed. We hypothesized that patients who inhaled an aroma composed of Lavandula x intermedia (Lavandin Super), Citrus bergamia (Bergamot), and Cananga odorata (Ylang ylang) would experience better sleep quality than patients who were not exposed to the intervention.

Design: This was a randomized, double-blind, cross-over pilot study.

Methods: Forty-two participants from an urban outpatient cardiac rehabilitation unit placed cotton balls infused with the intervention oils or an aromatic placebo mixture at their bedside for five nights. They completed the Pittsburgh Sleep Quality Index (PSQI) at the conclusion of the treatment. The PSQI is a well-established instrument with published evidence to support reliability and validity. After a one-week wash-out period, patients were switched to the opposing group and repeated the treatment procedure. Mean PSQI global scores of participants receiving essential oils and those receiving placebo were compared using student’s t-test.

Results: Lower PSQI global scores indicate better sleep quality. The mean PSQI global score when receiving the intervention oil was 4.9 and the mean PSQI global score when receiving placebo was 8. Sleep quality during treatment with essential oils was significantly better than sleep quality during treatment with placebo (t = -6.386, p = 0.0001). Hours of sleep were no different between groups, but patient-reported sleep quality on a single item, “how would you rate your sleep quality overall during the past week” was significantly better among the group exposed to essential oils (X2 = 4.5, p = 0.03) than the placebo group.

Conclusions: The effect of essential oil inhalation on sleep was substantial in this study (effect size: d = 1). Furthermore, results indicated that quality of sleep, rather than sleep duration was affected. Currently AACVPR guidelines direct practitioners to assess variables such as functional capacity, blood pressure, and girth, but ignore sleep assessment. Because sleep has been linked to cardiovascular outcomes, AACVPR certified programs should consider adding sleep assessment in plans for quality improvement of functional status clinical outcomes. A low-cost intervention with essential oils is one strategy to improve sleep in cardiac rehab patients.
Abstract ID: S221
Title: Evaluation of Subjects with Amputation Secondary to Diabetic Foot by Arm Ergometer Stress Testing
Track: Cardiac
Authors: Zavala Ramirez, Juana; Sahagun Olmos, Roberto C.; Sanjuan Rivas, Luis J.; Vázquez Lara Santoyo, Guillermina A.; Alavez Santiago, Dalila; Dergal Carreto, María; Ruiz Hurtado, María; Muñoz Velasco, Laura P.; Espinosa Jove, Irma G.
Institutions: 1. Instituto Nacional de Rehabilitación, Mexico City, Mexico DF, Mexico.

Introduction: Worldwide there are 347 million people living with diabetes, being one of the leading causes of morbidity and mortality in affected individuals. This increases the risk of amputation about 10 times more than non-diabetics. Diabetes mellitus (DM) may result in progressive deterioration of cardiac function, independently of other risk factors. One way to evaluate functional capacity in patients with diabetes and lower limb amputation is through a stress test in arm ergometer, which has a strong correlation with stress test in lower limb ergometer.

Purpose: To evaluate functional capacity and detect ischemic heart disease in a sample of individuals with lower limb amputation secondary to diabetic foot by performing a stress test in arm ergometer.

Design: Transversal, descriptive and retrolective.

Methods: We included patients evaluated in an adult cardiac rehabilitation unit with diagnosis of DM and lower limb amputation at any level secondary to diabetic foot, who have been evaluated with a stress test in arm ergometer. Variables of age, sex, diagnosis of arterial hypertension, effort during stress test, chronotropic response, pressor response, METS, maximum oxygen uptake, perceived effort by modified Borg scale, initial and final double product, positivity or negativity of the test and rhythm disturbances were registered. Medical record review was performed from January 2012 to June 2015. Descriptive statistics was used to describe and summarize data.

Results: 30 patients were included, with a mean age of 62.3 years; 56.7% had an altered chronotropic response, 63.3% showed an abnormal pressor response, 34.5% had electric positivity for heart ischemia during the test without showing clinical symptomatology and 30% presented rhythm disturbances. The mean functional capacity was 5.8 METS and the maximum oxygen uptake was 19.01 ml/kg/min, the perceived effort measured with Borg scale was reported in 5.8, while the initial double product was 10.21, the final double product was 30.69.

Conclusions: We found an adequate mean functional capacity for most of the basic activities of daily living. In more than one third of the study population we detected electrical signs of ischemia in previously unidentified and asymptomatic subjects. The rest of the tests were suspended by fatigue. The high proportion of asymptomatic electrical positive tests suggests the need of stress testing in this population as part of prosthetic evaluation process. Further studies are needed to get more conclusive results.
Abstract ID: S222

Title: Carotid Intima-media Thickness Evaluation by Radio-Frequency Based Echography; Risk Factors and Comorbidities in Patients with Lower Limb Amputation Secondary to Diabetic Foot

Track: Cardiac

Authors: Alavez Santiago, Dalila¹; Zavala Ramirez, Juana¹; Sahagun Olmos, Roberto C.¹; Hernández Díaz, Cristina¹; Pineda, Carlos¹; Múñoz Velasco, Laura P.¹; Espinosa Jove, Irma G.¹; Gutiérrez, Marwin¹; Vázquez Lara Santoyo, Guillermina A.¹

Institutions: 1. Instituto Nacional de Rehabilitación, Mexico City, Mexico DF, Mexico.

Introduction: Cardiovascular disease (CVD) is the leading global cause of death, and diabetes (DM) is one of its major risk factors; lower limb amputation (LEA) is about 10 times higher for diabetic than for nondiabetic individuals. Carotid intima-media thickness (cIMT) is a surrogate marker of CVD, and this can be increased in subjects with DM and LEA. There are no published studies that evaluate cIMT, risk factors and comorbidities in this population.

Purpose: Evaluate carotid intima-media thickness, risk factors and comorbidities in patients with lower limb amputation secondary to diabetic foot.

Design: Descriptive, cross-sectional study, non-probabilistic sampling.

Methods: We recruited 40 patients with LEA secondary to diabetic foot treated in the cardiac rehabilitation program at the National Institute of Rehabilitation; 5 were excluded. Medical history, cIMT and biochemical parameters were obtained. The main variables considered were: sex, age, amputation level, time of diagnosis of DM at amputation, cIMT, smoking, hypertension, dyslipidemia, stage of chronic kidney disease, cardiovascular risk and weight. An exploratory analysis for the detection of capture errors was performed on the database, its integrity was assessed and a descriptive analysis of the variables was performed.

Results: Of the 35 patients included, 11.4% (n = 4) were female, aged 61.83 ± 9.1 years old, 77.1% (n = 27) with amputation above the knee, 32.1 ± 40.5 months of amputation after DM diagnosis, an average of 700.14 ± 1780.33µ of cIMT was recorded; 97.1% (n = 34) were former smokers, 65.7% (n = 23) with hypertension, 48.6.7% (n = 17) with dyslipidemia, 45.7% (n = 16) in chronic kidney disease stage 2 and most were either overweight or obese 60% (n = 21).

Conclusions: About 37% of the patients had increased thickness in this sample, according to the conventional parameters, however, there are no values reported for the radio-frequency based measurements, so the results may be underestimated. It is necessary to continue the study, increasing the sample size and female sex representation and control values with this method to obtain more conclusive results.
Abstract ID: S223
Title: Impact of an Aerobic Exercise Program on Cardiovascular Health and Quality of Life of Patients with Amputation Secondary to Diabetic Foot: Preliminary Report
Track: Cardiac
Authors: Vázquez Lara Santoyo, Guillermmina A.1; Sahagun Olmos, Roberto C.1; Zavala Ramírez, Juana1; Pérez Molina, María R.1; Hernández Díaz, Cristina1; Pineda, Carlos1; Múñoz Velasco, Laura P.1; Espinosa Jove, Irma G.1; Beim, Joann C.2
Institutions: 1. Instituto Nacional de Rehabilitación, Mexico City, Mexico DF, Mexico. 2. Helen Hayes Hospital, Suffern, New York, United States.

Introduction: According to World Health Organization (WHO), 7 out of 10 amputations were performed in people with diabetes mellitus (DM), which negatively impacts their overall health and mobility. It has been reported fatigue and low exercise capacity in individuals with DM. There are not published studies about the impact of aerobic exercise on cardiovascular health and quality of life in patients with amputation secondary to diabetic foot.

Purpose: Assess the impact of an aerobic exercise program on cardiovascular health and quality of life of patients with amputation secondary to diabetic foot.

Design: Quasi-experimental, prospective, descriptive study; preliminary report.

Methods: Inclusion criteria were lower limb amputation secondary to diabetic foot. Orthopedic or neurological conditions that restrict participating in aerobic exercise and patients who were contraindicated for exercise testing and training were excluded from the study. Outcome measures were; functional capacity (assessed by arm exercise testing), serum levels of HDL-cholesterol, LDL-cholesterol, total cholesterol, fasting glucose; scores in World Health Organization Quality of Life-BREF (WHOQOL-BREF) 26-item interview-administered & World Health Organization Disability Assessment Schedule (WHODAS) 2.0 36-item interviewer-administered questionnaires; all were measured before and after the program. The subjects underwent a 6-week structured individually tailored upper and lower-limb aerobic exercise program, 3 times a week of 45 minutes per session. The integrity of the database was evaluated and then descriptive statistics were performed.

Results: 5 subjects met the inclusion criteria, 3 completed the program. The participants were male, between the ages of 50 and 68 years, all subjects had amputation of left lower limb (1 below the knee and 2 above the knee), average time of amputation was 1 year, average time with DM was 11 years. A slight trend of improvement was observed in cholesterol levels; there was improvement functional capacity (18.3 to 20.8 maximal oxygen uptake), WHOQOL-BREF (92 to 76 points) and WHODAS 2.0 (78 to 64 points) questionnaires scores.

Conclusions: This program may have beneficial effects on functional capacity, some biochemical parameters, perception of disability and quality of life, in individuals with lower limb amputation secondary to diabetic foot, however it is necessary to continue the study, increasing the sample size to obtain conclusive results. We believe that our sample despite being small gives important information because there are no reports of aerobic exercise programs in this population.
Abstract ID: S224
Title: Smart Telehealth Exercise Intervention to Reduce COPD Readmissions
Track: Pulmonary
Authors: Sanders, J. Greg, MS\(^1\); Anderson, Erica, RRT\(^1\); Schumann, Christopher, MS\(^1\); Dransfield, Mark T., MD\(^1\); Bamman, Marcas M, PhD\(^1\); Bickel, C. Scott, PT, PhD\(^1\); Lowman, John D., PT, PhD\(^1\); Bhatt, Surya P., MD\(^1\)

Introduction: Hospitalizations for acute exacerbation of chronic obstructive pulmonary disease (COPD) account for up to 85% of COPD-related healthcare costs. CMS has initiated penalties for readmissions exceeding historic rates. Pulmonary rehabilitation (PR) is associated with reduction in COPD exacerbations, but enrollment is low and attrition is high.

Purpose: We hypothesized that an early exercise intervention of a Remote telehealth Pulmonary Rehabilitation (RPR) program would result in reduction of 30-day all-cause readmission rates.

Significance: Approximately 20% of patients hospitalized for COPD exacerbation are readmitted within 30-days.

Designs: Patients hospitalized for acute exacerbation of COPD, at a single center, were enrolled prospectively to participate in this observational cohort. Readmission rates were compared to controls without PR and with usual PR, and functional outcomes assessed. Patients exercised according to AACVPR Guidelines for PR, via smartphone video-conferencing, 2-3 times per week for 12 weeks.

Methods: Neuromuscular electrical stimulation was applied to quadriceps (bilateral), 30 minutes per day for 10 days, initiated as in-patient. At follow-up, patients were oriented to RPR. Assessments were made of the following: 30 second chair stand test (30SCST) to assess skeletal muscle dysfunction, functional capacity using the 6 minute walk test (6MWT), dyspnea using the San Diego Shortness of Breath Questionnaire (SOBQ), COPD-related quality of life using the COPD Assessment Test (CAT), and the Psychosocial Risk Factor Survey (PRFS). Readmission rates were compared to controls using independent t-test, and paired t-test was used to compare outcome measurements before and after intervention.

Results: 22 subjects were enrolled. No drop-outs were noted in RPR. Traditional PR noted 50% attrition. There was significant reduction in the primary outcome of 30-day readmissions with RPR (16% in 80 controls without PR, 8% in 12 controls with usual PR, and 0 in RPR;p<0.001). There was significant improvement in 6MWT (325+/-94 vs 271+/-79 m;p=0.002), 30SCST (4.2+/-1.2 vs 4.5+/-1.3;p=0.07), PRFS-anxiety and hostility subdomains (p<0.05), CAT (18.4+/-7.8 vs 13.5+/-7.6;p=0.02) and SOBQ (62.1+/-26.7 vs 52.1+/-30.2; p=0.001).

Conclusions: RPR reduces 30-day all-cause readmission rates following hospitalization for COPD exacerbation. RPR is associated with lower attrition rates and results in significant improvement in functional outcomes.

Implications: RPR is a viable option to increase PR accessibility, and results in lower 30-day readmission rates following COPD exacerbations, compared to controls. These benefits can be extended to other chronic disease models.
**Abstract ID:** S225  
**Title:** Fracture Risk Assessment and Osteoporosis in Cardiac Rehabilitation Program  
**Track:** Cardiac  
**Authors:** Quinn, Larry¹; Sarmiento, Juan M.²; Medina, Oscar²; Dávila, Fabián²  
**Institutions:** 1. Sports Medicine Program, Universidad del Bosque, Bogotá, Colombia. 2. Centro de la Prevención Cardiovascular Shaio, Bogotá, Colombia.

**Introduction:** In recent years it has been shown that individuals with cardiovascular disease have an increased risk of bone loss and associated fractures, especially in hip and spine.  
**Purpose:** To determine if there is a high percentage of osteoporosis in patients with cardiovascular disease in a cardiac rehabilitation program, and associated with it if there is a high prediction in fracture risk assessed by the FRAX tool turn appreciate that cardiovascular disease or cardiovascular procedures at lower bone mineral density associated reported by the hip T-score.  
**Significance:** Knowing the statistics from osteoporosis and osteopenia in cardiovascular patients, could make protocols of assessment and identification of fracture risk associated with the disorder in the balance, tools (FRAX), in order to establish exercise programs aimed at improving bone health.  
**Design:** It is a transversal study, analytical cut, which brought together 59 patients attached to a cardiac rehabilitation program phase II in the Shaio Clinic, with greater than or equal to 50 years old, during July and August 2015.  
**Methodology:** All patients underwent a bone density through a reference densitometer GE Lunar iDXA, fourth generation and prediction of hip fracture risk and higher was conducted by the FRAX tool, available on the web. Qualitative variables were described as absolute and relative frequencies; the continuous variables were estimated distribution through the Kolmogorov normality test Smirnov and distribution described by median and interquartile range. The difference distribution medium and hip T-score versus dichotomous qualitative variables with test Mann-Whitney (non-parametric) for a value of p <0.05 for different scenarios were analyzed.  
**Results:** Mean age was 64 years, 66.2% of subjects were male. It was found that 66.2% of the patients, presented in consideration of densitometry, any alteration of bone mineral density in the hip or lumbar spine, specifically 45.7% had osteopenia and 20.5% osteoporosis, a bone findings remaining 33.8% of normal subjects. This study found that present of history of cerebrovascular disease and a history of pacemaker implantation, were associated with the lowest value in the T-score of hip, statistically significant results for the test Mann-Whitney (p = 0.034) and (p = 0.010) respectively. None of the subjects reported a high value for the risk of hip fracture and major fracture valued by FRAX.  
**Conclusions:** The study showed than can be found patients with bone density disorders, defined as osteopenia and osteoporosis. Having a history of cerebrovascular disease and the placement of pacemakers, are clinical conditions that are associated with low values in the hip T-score, in this specific group of patients.  
**Implications:** This research is intended to test, promote and strengthen the need to assess bone mineral density and fracture risk study in a cardiac rehabilitation program phase II, promoting the need for assessment protocols bone quality and fracture risk in all patients older than 50 who enter such programs.
Abstract ID: S226
Title: Modulation of Inflammatory Markers and Cardiovascular Disease with Heart Failure Interval Exercise in 2640 msm
Track: Cardiac
Authors: Pereira, Orlando J.¹; Sarmiento, Juan M.²; Dávila, Fabián²; Lineros, Alberto¹

Introduction: Heart failure is a pathophysiological state in which a chronic ventricular dysfunction occurs, generating an inflammatory response, accompanied neuroendocrine deterioration of functional capacity.

Problem: The type and dose of exercise needed to increase health benefits are controversial and there are no clear protocols for the prevention of heart failure related disorders.

Purpose: To determine the modulation of markers of cardiovascular disease and inflammatory response in patients with heart failure, after high-intensity interval (HIIT) exercise 2,640 msm.

DESIGN: study Uncontrolled before and after; Six male patients diagnosed with heart failure, ejection fraction left ventricle lower (LVEF) of 40% in optimal treatment; direct peak oxygen consumption, ejection fraction of the left ventricle, natriuretic peptide levels were measured NT - proBNP and C-reactive protein, a week before and after the end of the program of high-intensity interval exercise of 12 weeks.

Results: The mean age of patients was 66 years; 83.3% had ischemic heart failure, 100% of the subjects completed the cardiovascular rehabilitation, oxygen consumption was increased in 3.63 ml / kg / min (p 0.033); The weight decreased by 2.77 kg (p 0.016); BMI decreased 0,82Kg / m2 (p 0.028); the increase of the maximum MET 1.10 (p = 0.028) functional capacity; The natriuretic peptide NT-proBNP decreased 31.3%, LVEF increased by 8.6% (not significant), no adverse events or decompensated heart failure.

Conclusions: HIIT is a safe non-drug strategy and could be an adjunct to these patients; improves aerobic capacity, body composition modifications, apparently it could be a non-pharmacological help to improve cardiac remodeling.

Implications: These findings may have important benefits when HIIT is performed in patients with compensated heart failure; must undergo cardiopulmonary exercise testing integrated for prescribing exercise, proper medical evaluation, exercise sessions should be monitored stopping generate significant benefits in this type of cardiovascular disease; In the future larger studies are needed to confirm these results.
Abstract ID: S227
Title: Arterial Blood Pressure Response to Repeated Cuff Re-inflations without Interposed Rests
Track: Cardiac
Authors: Shaw, Donald, PT, PhD, FAACVPR; Johnson, Stephanie; Hefferon, Tamara
Institutions: 1. Physical Therapy Program, Franklin Pierce University, Goodyear, Arizona, United States.

Introduction: Immediate blood pressure cuff re-inflation without an interposed rest is thought to promote venous congestion and render spurious arterial blood pressure (ABP) values. Recently published data question this assumption. Yet to be studied is the cumulative effect of multiple cuff re-inflations on ABP when obtained sequentially and without an interposed rest.

Purpose: The purpose of the study is to determine if five rapid blood pressure cuff re-inflations obtained without interposed rests progressively alter individual ABP values.

Design: This was a prospective, repeated measures study utilizing a convenience sample of university health professions students.

Methods: Twenty (10 males, 24.8±2.5; 10 females, 23.5±1.6 yrs) students volunteered to participate in the study. Following receipt of informed consent, subjects were moved to a separate room for 5 minutes of quiet rest. Upon return to the testing area, each subject was seated comfortably with a blood pressure cuff affixed to the left arm following standard protocol. A Welch Allyn Connex® 6000 Series Vital Signs Monitor was used to obtain all ABPs. No rest interval was provided between successive ABP measurements with cuff re-inflated immediately following deflation. Investigators did not engage subjects in conversation once the cuff inflation protocol was initiated. A total of five ABP trials (T) were administered utilizing this rapid re-inflation procedure. Alpha level was set at p ≤ 0.05; data were analyzed using SPSS Version 23 software. Bonferroni adjustment was provided for all repeated measure comparisons.

Results: Mean±SD mmHg for systolic (SBP) and diastolic (DBP) pressures over five trials were: T1 - 125.6±16, 75.8±5.7; T2 - 120.5±16.1, 74.3±6.7; T3 - 120±15.4, 75.4±6.8; T4 - 118.8±15.4, 73.9±6.5; and T5 - 119.8±14.7, 73.8±6.9. Pairwise comparisons revealed significant differences only between SBPs T1 vs T2 – T5 (p ≤ .015). Significant differences between DBPs over five trials were: T1 vs T2, T4, T5 (p ≤ .041); and T3 vs T4, T5 (p ≤ .021).

Conclusions: All SBPs were lower after T1. This same trend was observed for all DBPs except for T3. The T3 DBP approximated that observed at T1 (i.e., 75.8 mmHg vs 75.4 mmHg). Given the range of change for both SBPs (6.8 mmHg) and DBPs (2.0 mmHg) was quite small, it appears no mechanism is at play to alter ABPs when obtained sequentially without interposed rests. The higher ABPs observed at T1 are likely a sympathetic response to initial study participation. We conclude the time interval of cuff re-inflation has a negligible effect on ABP measurement.
Abstract ID: S228
Title: The Dose-response Effects of Cardiovascular Rehabilitation on Self-reported Measures of Functional Capacity, Quality of Life, Eating Habits, and Depression in Cardiac Patients
Track: Cardiac
Authors: Wishman, Ashley, MS, CES, CSCS, PES1; Davila, Edward, MS, RCEP1
Institution: 1. Bozeman Deaconess Hospital, Bozeman, Montana, United States

Introduction: It has been well documented that regular physical activity (PA) can improve cardiorespiratory and muscular fitness. However, there is less research that highlights the impact of PA and education interventions on PA behavior and depression.

Purpose: For cardiac patients undergoing formal cardiac rehabilitation, the intervention consists of diet, exercise, and risk reduction education. Much of the cardiac rehabilitation literature highlights physical adaptations due to the exercise therapy, however, the purpose of the current study was to evaluate the relationship between the number of completed Cardiac Rehabilitation (CR) sessions and health and behavior related outcomes in a group of cardiac patients.

Design: The current investigation was a retrospective cohort study.

Methods: Data from one hundred and eighteen adults (Mean ± SD: 65.1± 12.2 yrs; 172.6 ± 9.2 cm; 85.3 ± 18.0 kg; 28.6 ± 5.3 BMI) participating in phase II CR were used in the analyses. All participants voluntarily enrolled in CR which consisted of clinically-supervised exercise training and diet, exercise and risk reduction education for up to 36 sessions. Participants were categorized within a Low (3-12 sessions), Moderate (13-24 sessions), or High Compliance (25-36 sessions) group depending on how many CR sessions were completed. Dependent variables included percentage change in pre and post scores on various surveys including Dartmouth COOP (Dart), PHQ-9, Nutrition Quest Sodium Screener (SS), Nutrition Quest Fat Screener (FS), and Duke Activity Status Index (DASI). Pre/post data were analyzed using paired t-tests for participants within each exercise group. To mitigate potential inflation of the overall Type I error rate, a Bonferroni correction factor was applied to the statistical comparisons, resulting in a p-value of < 0.000 required for determining statistical significance.

Results: Within the Low Compliance group, the DASI was statistically improved between measurements (p-value < 0.000). The Moderate Compliance group resulted in statistically significant improvements for Dart, PHQ-9, SS, and DASI (p-value < 0.000). Dart, PHQ-9, SS, FS, and DASI were all significantly improved between measurements for the High Compliance group (p-value < 0.000).

Conclusions: The results of the current study indicate there is benefit to attending CR at each level. However, the increase in benefit corresponds with an increase in number of sessions attended. Therefore, the data suggests that 25-36 CR exercise sessions may result in greater benefits when compared to less than 25 CR exercise sessions in this population.
Abstract ID: S229
Title: Initial Outcome Measurements and Program Adherence for Respiratory Rehabilitation
Track: Pulmonary
Authors: Buckner, A.¹; Daugherty, S.¹; Wishman, A.¹; Davila, E.¹²,³
Institutions: 1. Department of Cardiac and Pulmonary Rehabilitation, Bozeman Health Deaconess Hospital, Bozeman, Montana, United States. 2. Department of Fitness, Ridge Athletic Clubs, Bozeman, Montana, United States. 3. Department of Recreational Sports and Fitness, Montana State University, Bozeman, Montana, United States.

Introduction: Respiratory rehabilitation (RR) has shown beneficial in slowing progression of chronic respiratory diseases. Attendance in RR is dependent, in part, on self-efficacy. Therefore, psychosocial status of respiratory patients may play a major role in the adherence of patients attending RR programs.

Purpose: Compliance is a consistent obstacle for RR patients. The purpose of this current study was to evaluate the relationship between RR compliance and initial self-reported psychosocial status, as measured by the PHQ-9 survey, in respiratory patients.

Design: The current study is a retrospective cohort study.

Methods: Data was collected from sixty patients (Mean ± SD: 67.1±14.9 years, 91.9 ± 27.9kg, 169.1 ± 11.2cm) participating in RR. All participants voluntarily enrolled in the RR program. Participants were separated into categories depending on their PHQ-9 score: Low (0-4), Moderate (5-14), and High (15 and greater). Compliance data for each patient for each group were then analyzed using a Kruskal-Wallace One-Way Analysis of Variance with Mann-Whitney U Tests for post-hoc analyses.

Results: There was no statistically significant differences detected between groups (p >0.05). Despite no statistical differences, the data showed a trend indicating individuals who scored lower upon initial PHQ-9 screening attending more RR sessions when compared to individuals who scored higher. Thus, patients in the Low category tended to attend more RR sessions.

Conclusion: The results from the current study highlight the potential impact and importance of psychosocial status has on RR compliance. With a lower initial PHQ-9 score, it can be speculated that patients attend more RR session and thus, increase the likelihood of achieving many of the benefits associated with regular physical activity. Considering the trends of the current study, further research is warranted.
Abstract ID: S230
Title: Comparison of Activity Forces between Patients Who Follow Traditional Sternal Precautions versus Those Who Use a Unique Post-sternotomy Discharge Education Model: “Keep Your Move in the Tube”
Track: Cardiac
Authors: Carbone, Pasquale, MS¹
Institution: 1. Baylor Jack and Jane Hamilton Heart and Vascular Hospital, Dallas, Texas, United States.

Introduction: Because of concerns about sternal dehiscence, sternotomy patients (CABG, transplant, LVAD, valve repair) are generally instructed not to lift more than 5 to 10 pounds for 10 to 12 weeks. However, if patients practice Keep Your Move in the Tube (an alternative to current sternal precautions), activities of daily living (ADLs) can be performed without weight or time restrictions.

Purpose: To compare the force required to lift 10 pounds (the upper limit suggested by current sternal precautions) with the forces exerted by sternotomy patients who practiced Keep Your Move in the Tube while performing a series of practical ADLs.

Design: In a prospective pilot study, force dynamometry data were collected from 10 sternotomy patients enrolled in cardiac rehabilitation (7 men and 3 women, aged 41 to 78 years) as they performed ADLs while practicing Keep Your Move in the Tube.

Methods: A Primus RS force dynamometer was used to obtain isometric 1-RM strength measurements for the following simulated activities: placing an object overhead, picking up an object from the floor, and opening a door. Afterward, dynamic movements that simulate rising from a bed and rising from a chair were performed three times by pushing against the force dynamometer. One-sample t-tests were used to compare the average force exerted for each of the five activities with 12.5 force pounds (the force required to lift a 10-pound weight).

Results: The subjects exerted (mean ± SD) 46.9 ± 21.1 force pounds when lifting overhead and 83.9 ± 34.7 force pounds when lifting from the floor. Additionally, they exerted 28.5 ± 13.7 force pounds while pulling a door open, 27.0 ± 7.8 force pounds while rising from bed, and 26.6 ± 14.7 force pounds while rising from a chair. For each of the five simulated activities, the average force exerted by the subjects differed significantly from the force required to lift 10 pounds (p-values: 0.0003, 0.0001, 0.0025, 0.0001, 0.0070 respectively). No adverse events were observed.

Conclusions: While practicing Keep Your Move in the Tube, these sternotomy patients were able to lift, pull, and push with substantially more force than would be required for the 10-pound restriction recommended by current sternal precautions. Furthermore, they performed these activities an average of 3 weeks and 3 days after surgery (range, 6–45 days), far sooner than the usual 10- to 12-week restriction.
Abstract ID: S231
Title: A Quality Improvement Cohort to Evaluate the Use of a Breath-Responsive, Variable-Bolus - Oxygen Conserving Device (BRVB-OCD) to Improve the Quality of Life and Oxygen Source Utilization in Patients with COPD
Track: Pulmonary
Authors: Pertelle, Vernon, MSc, MBA, RRT, LVN, CCM; Pereira, Isabel, MD; Rice, Lacey, RRT; Stephens, Alisa, PhD
Institutions: 1. Stratihealth, Howard Hughes Center, Los Angeles, California, United States.

Purpose: Determine the effects of a breath-responsive, variable-bolus – oxygen conserving device (BRVB-OCD) technology in the delivery of ALTOT on improvements in functional activity with activities of daily living; dyspnea, and oxygen source utilization in a cohort of patients that use the BRVB-OCD.

Methods: Protocol for the study was reviewed by IRB and exempted for quality improvement. Patients were selected for inclusion criteria (COPD: FEV1≤70%; FEV1/FVC≤70%; oxygen 24 hours per day; ambulatory oxygen source with CF or PDOD). Patients used the BRVB-OCD for 6-weeks prior during a previous study and following the study period, were consented and evaluated for an additional 4-weeks by a respiratory therapist (RT) in the home to determine continued improvements in QOL and oxygen source utilization. A total n=5 selected for study between August 2015 - October 2015; patients completed Baseline Dyspnea Index (BDI), Chronic Respiratory Disease Questionnaire (CRQ); Daily Oxygen Use Log* (DOUL), and a Six Minute Walk Distance (6MWD) to identify a baseline BRVB-OCD setting for SpO2≥90% at rest and activity. Patients provided with pulse oximeter and self-administered Transitional Dyspnea Index (TDI), CRQ; *DOUL, and 6MWD by RT with oximetry to achieve SpO2≥90% at rest and activity while using BRVB-OCD at 2-week intervals. Patients encouraged to use the BRVB-OCD during usual activities in which an ambulatory oxygen source is used (both in and out of the home, with activity and during exercise). Patients instructed to use continuous flow (CF) LTOT source while sleeping. (*completed daily by patient)

Results: Four Weeks Following Baseline: The mean ± SD for 6MWD improved significantly (P<0.02) and correlated with CRQ, TDI (P<0.05). The Paired T-tests indicated that on BRVB-OCD that CRQ functional activity domain and TDI measures correlated in both dyspnea groups. All patients showed significant improvement in O2 source utilization (≥50% reduction).

Conclusions: Patients who were administered ALTOT with a breath-responsive, variable-bolus – oxygen conserving device (BRVB-OCD) technology experienced improvements in functional activity; dyspnea, and health related quality of life. Patient’s SaO2-r and SaO2-a; improved in all instances during the performance of usual activities (in the home and outside the home and exercise). Oxygen source utilization was reduced in all patients.

Implications: A breath-responsive, variable-bolus – oxygen conserving device (BRVB-OCD) technology; when used with an ambulatory oxygen source in patients with moderate to severe COPD will help improve the patient’s long-term oxygen therapy (LTOT) with improved oxygen saturations leading to improved quality of life, while reducing oxygen source utilization. These results demonstrate a benefit to the patient and COPD population; the oxygen source provider and healthcare system. (The Institute for Healthcare Improvement (IHI) Triple Aim)
Abstract ID: S232
Title: The Effect of Smoking on Exercise Perception and Intentions for Cardiac Rehabilitation Enrollment among Patients Hospitalized with an Acute Cardiac Condition
Track: Cardiac
Authors: Riley, Hayden, BS; Headley, Samuel, PhD; Winter, Christa, PhD; Mazur, Sara, PhD; Ainani, Nitesh, MD; Turk, Ahmad, MD; Pack, Quinn R., MD MSc
Institutions: 1. Springfield College, Springfield, Massachusetts, United States. 2. Baystate Medical Center, West Springfield, Massachusetts, United States.

Introduction: Cardiac rehabilitation (CR) attendance has been associated with improved smoking cessation outcomes among smokers hospitalized for an acute cardiac condition; however, for unclear reasons, patients who smoke are consistently less likely to enroll in CR.

Purpose: To determine patient perception of exercise and assess smoking as a factor in CR enrollment.

Design: Prospective patient survey.

Methods: We included patients eligible for outpatient CR who were current smokers at the time of their hospital admission. We developed and administered a 29-question survey which assessed patient opinions of tobacco use, exercise, and CR enrollment. We also administered the Fagerstrom Test for Nicotine Dependence (FTND), Global Physical Activity Questionnaire, Hospital Anxiety and Depression Scale (HADS), and Confusion Hubbub and Order Scale (CHAOS) surveys.

Results: Of the 54 patients approached, 40 (74%) patients completed the survey (65% male, 57 ± 10 years, 70% Caucasian, 50% with myocardial infarction and subsequent percutaneous coronary intervention, 68% with no regular physical activity). Most patients (70%) reported being interested in quitting smoking and felt that cessation medications (45%), CR (43%), and starting an exercise program (38%) would increase their likelihood for a successful cessation attempt. Most patients (73%) expressed an interest in attending CR. However, patients indicated that quitting smoking, consistently taking prescribed medications, attending medical appointments, and reducing stress were higher priority health behavior changes than attending CR. Additionally, 58% of patients indicated moderate to high nicotine dependence (FTND score ≥ 5), 48% indicated abnormal levels of anxiety (HADS anxiety score ≥ 8), 33% indicated abnormal levels of depression (HADS depression score ≥ 8), and 15% indicated at least moderate levels of life-chaos (CHAOS ≥ 14).

Conclusions: Hospitalized smokers who are eligible for CR report significant interest in quitting smoking, attending CR, and beginning an exercise program. As a group, these patients show high levels of anxiety, depression, and indicate a strong interest in stress management programs. These results suggest that messages about the role of CR in the treatment of depression, anxiety, and stress are likely to resonate with smokers and increase their enrollment rates in CR.
Abstract ID: S233
Title: Reasons for Declining to Participate in Home-based Cardiac Rehabilitation
Track: Cardiac
Authors: Schopfer, David, MD, MAS¹
Institution: 1. San Francisco VA Medical Center, San Francisco, California, United States.

Introduction: Referral to cardiac rehabilitation (CR) is one of nine performance measures for patients with ischemic heart disease, but only ~10% of eligible Veterans participate. Home-based CR programs may improve participation in CR, yet many still decline to enroll.

Purpose: We sought to understand the factors associated with declining to participate in a CR program when home-based CR is available.

Design: We used a qualitative study design to examine patients’ rationale for declining participation in CR using a patient questionnaire given at the time of the decision to not participate in either a facility-based or home-based CR program.

Methods: We reviewed 103 patient charts for documentation of the reason for declining to participate in any CR to determine broad categories for declining. Based on these responses we then developed a questionnaire which was given to 52 patients to report their reason(s) for declining and rank the importance of each factor on their decision using a 4-point Likert scale (1=not at all, 2=a little, 3=somewhat, 4=very much).

Results: Overall, 29 patients agreed to complete the questionnaire. The most common reasons for declining were: not interested in making lifestyle changes (52%), too busy and/or other demands (48%), do not want frequent phone calls (41%), do not need education and intend to achieve goals on their own (34%), and family obligations (31%). The responses which were ranked as most important were: too busy (mean 2.1 ± standard deviation 1.3), do not want to make lifestyle changes (2.1 ± 1.2), and do not want frequent phone calls (1.0 ± 1.3). There were no significant differences by clinical indication.

Conclusion: Patients report a variety of issues for declining to participate in a CR program. Despite the convenience of a home-based CR program many patients remain uninterested or uncommitted to making behavioral changes necessary to reduce secondary cardiovascular risk.
Abstract ID: S234
Title: High-Intensity Aerobic Interval Training in a Patient Post Pericardiostomy While Undergoing Concurrent Radiation Therapy for Prostate Cancer
Track: Cardiac
Authors: Shultz, Adam M., MS; Thomas, Randal J., MD; Squires, Ray W., PhD
Institution: 1. Mayo Clinic, Rochester, Minnesota, United States

Introduction: Limited evidence exists regarding high-intensity aerobic interval training (HIIT) in patients with recent pericardiostomy and/or undergoing concurrent radiation therapy.

Purpose: The purpose of this study was to present the cardiac rehabilitation intervention for a 50 year old male status post infectious pericarditis, subxiphoid pericardiostomy, and radical retropubic prostatectomy undergoing concurrent radiation and androgen deprivation therapy (ADT) for Gleason 4+5, pT2c, N1, MX, R1 node positive adenocarcinoma of the prostate without metastasis. Specifically, this study investigated the safety and efficacy of HIIT in this subset of patients.

Design: Retrospective cardiac rehabilitation database analysis

Methods: The patient initiated outpatient cardiac rehabilitation 13 days post pericardiostomy and completed 34 exercise sessions over the course of 20 weeks. Weekly radiation treatments totaled 36 fractions; 6480 cGy were administered to the prostatic fossa and pelvic lymph nodes. ADT was concurrently administered. The patient was approved for exercise training to tolerated levels by physicians in cardiology and oncology, respectively, who followed the patient throughout the program. Moderate intensity aerobic and resistance training, flexibility training, and treadmill HIIT was performed an average of twice weekly. HIIT was initiated approximately one month after program initiation and performed 1-2 times weekly. Standard HIIT program prescription was utilized that included a rating of perceived exertion (RPE) of 15-17 (out of 20) for 3-8 (+) intervals of 60-240 seconds in duration with 60-300 seconds of moderate intensity (RPE 11-13) separating each subsequent interval. Standardized assessments were performed at program initiation and completion which included a six-minute walk test, body composition analysis via dual x-ray absorptiometry, estimated one repetition maximum leg press, the Patient Health Questionnaire (PHQ-9) depression screen, and the Dartmouth Quality of Life questionnaire.

Results: Outcome data revealed a 49% improvement in six-minute walk distance, a 52% improvement in quality of life measures, and a 100% improvement in depression related qualities. The patient scored 9 on the PHQ-9 at program initiation, which is indicative of mild depression. The patient scored 0 at program completion, indicating complete reversal of depressive characteristics. Additionally, a 23% increase in estimated one repetition maximum leg press and 8% reduction in total body weight were observed. No adverse events occurred during the program.

Conclusions: HIIT appears to be safe and efficacious in improving exercise capacity, quality of life, and characteristics of depression in a patient status post infectious pericarditis, pericardiostomy, and radical retropubic prostatectomy undergoing concurrent radiation therapy and ADT.
Abstract ID: S235

Title: Pulmonary Rehabilitation Is Associated with Improved Gait Speed

Track: Pulmonary

Authors: Teneback, Charlotte C., MD\textsuperscript{1,2}; Hunton, Deborah, RT\textsuperscript{1}; Stevens, Diane, PT\textsuperscript{1}

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Introduction: Chronic obstructive pulmonary disease (COPD) is associated with significant functional impairment and limitations, including decreased exercise tolerance, muscle strength and balance, and is the primary diagnosis in patients referred to pulmonary rehabilitation (PR). There are a number of important functional outcomes that can be measured and used as evidence of successful rehabilitation. One of the simplest of these is the 4 meter gait speed, which has been shown to have strong correlations to exercise capacity but also seems to reflect the multisystem aspects of disease, with correlations to dyspnea and lung function, among other things. We hypothesized that completion of pulmonary rehabilitation leads to improvement in 4 meter gait speed.

Methods: Data were obtained in a prospective, observational fashion. Gait speed was measured prior to and following the completion of a standard 16-visit PR program in 16 participants. Additional data obtained included age, body mass index (BMI), lung function, St. George Respiratory Questionnaire (SGRQ), and 6 minute walk distance. Paired t-tests were used to compare pre and post scores, and Pearson correlations were performed to evaluate baseline relationships.

Results: The average gait speed prior to PR was 0.85 m/s. The gait speed improved significantly following completion of the program, to 1.01 m/s ($p<0.001$). In addition, the gait speed was significantly correlated with age ($p<0.05$), and 6 minute walk distance ($p<0.0001$) but not with BMI, lung function as measured by FEV\textsubscript{1}, or SGRQ.

Conclusions: Completion of pulmonary rehabilitation was associated with a significant improvement in gait speed. The use of this simple test may be able to provide valuable information to the clinician in terms of level of daily functioning. Unlike the 6 minute walk test, gait speed is not subject to fatigue, and is easily performed in limited space. Our findings suggest that the use of gait speed as an outcome in PR warrants further investigation.