**Intervention 1: Aerobic and Strength Training**

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| **Title/Author/Year** | **The Effect of Progressive Resistance Training on Aerobic Fitness and Strength in Adults with coronary Heart Disease: A systematic review and Meta-analysis of RCT’s**  Matthew Hollings, Yorgi Mavros, Jonahatan Freston, Maria Fiatarone Singh  June 5, 2017 |
| **Number of Subjects** | 34 included studies, 1,940 participants |
| **Inclusion/Exclusion criteria** | **IC:** Full length article in peer-reviewed journal, RCT, human participants with CHD, recent cardiac event, coronary artery surgical intervention, intervention included PRT1  **EC:** documented HF diagnosis regardless of EF, participants undergone valvular or heart transplant, comparison group did not permit isolation of PRT, intervention < 3 weeks1 |
| **Outcome Measures and Time Frame** | Muscular strength: IRM, maximal voluntary contraction (MVC), isokinetic (peak torque) 1  Cardiorespiratory fitness: VO2 max, peak workload on cycle ergometer or treadmill1  Included studies were between 3-26 weeks duration |
| **Description of Intervention** | Studies were either PRT vs. control, PRT vs. aerobic training (AT), or combined training (CT) vs. AT  The interventions in each study consisted 2-5 exercise sessions per week where PRT included machine-based, whole-body and multisegmented movements. 1 Intensity and volume of exercises widely varied with light to maximal intensity and 1-12 exercises and 2-30 reps respectively. 1 AT was primarily moderate intensity at 60-95% HRmax at 18-90min durations of cycling, walking and jogging. 1 For those individuals in the control groups, supervisors recommended they maintain their regular ADL’s and activity levels. 1 |
| **Results** | When PRT was compared with AT both showed overall improvements in CRF but there was no significant difference between the two groups when It came to VO2max and work capacity. 1 However, with CT compared to AT there appeared to be significant improvements in peak work capacity. 1 In terms of overall muscular strength, greater gains were seen in the PRT group compared to the AT group, and the CT group compared to AT group but only the studies comparing CT vs. AT were considered to produce meaningful and significant results. 1 |
| **Conclusion** | After analyzing and cross-comparing the results of the 34 included studies, the authors came to a few different conclusions. The first being PRT and AT similarly improved an individual’s cardiorespiratory fitness. 1 Secondly, programs that combined PRT and AT showed even greater significant gains in fitness, strength and overall health benefits. 1 Therefore, while PRT and AT can be successful individually, components of both should be incorporated to maximize functional and health related outcomes. |
| **Title/Author/Year** | **Comparative Effectiveness of aerobic, resistance and combined training on cardiovascular disease risk factors: A randomized controlled trial.**  Elizabeth Schroeder, Warren Franke, Rick Sharp, Duck-Chul Lee  January 7, 2019 |
| **Number of Subjects** | 69 participants |
| **Inclusion/Exclusion criteria** | **IC:** 45-75 years old, elevated BP or hypertension without taking anti-hypertensive meds, overweight/obesity(BMI 25-40kg/m2), sedentary lifestyle. 2  **EC:** have unstable coronary heart disease/decompensated heart failure/severe pulmonary hypertension, those who smoked, pregnant women, those who would be gone 2 or more weeks during the intervention2 |
| **Outcome Measures and Time Frame** | Measures: Blood pressure + heart rate (by Sphygmocor EXCEL), BMI, body composition (via multi-frequency bioelectrical impedance analysis (BIA)) , lipid profile + glucose (via blood draw) cardiorespiratory fitness (via submax treadmill exercise following Balke and Ware protocol), max contractile strength (via seated chest and leg press 1RM) 2  8 week intervention program |
| **Description of Intervention** | Throughout the duration of the program, individuals participated in 60 minute sessions 3x/week while the control did not participate in the intervention. 2 The Aerobic only group used a treadmill or stationary bike starting at 40% HR reserve and progressed to 70% HR reserve. 2 The resistance only group completed 12 exercises consisting of “chest press, shoulder press, pulldown, lower back extension, abdominal crunch, torso rotation, biceps curl, triceps extension, leg press, quad extension, leg curl and hip abduction.” 2 Initially participants started with 2x18-20 reps and progressed to 3x10-14 reps. 2 The combination group had 30min of aerobic exercise and 30 minutes of resistance training using 8 of the previously mentioned exercises and only 2 sets were completed. There was also a registered dietitian who counseled all participants. 2 |
| **Results** | Because the protocol was supervised by specialists the average participation for aerobic and resistance training was roughly 100% but authors did note that activity outside the program did not significantly change (indicated by pedometer counts). 2 After 8 weeks of training the CT group showed a reduction of 4mmHg in peripheral and central DBP as well as 2bpm decrease in resting HR for both the CT and AT groups. 2 Cardiorespiratory fitness increased in the AT and CT group by 7.7ml/kg/min and 4.9 ml/kg/min respectively, LE and UE muscular strength increased significantly in the RT and CT groups by 13kg and 11kg respectively. 2 The resistance group was the only one to show a difference in lipid profile with a decrease of 26mg/dL in triglycerides. 2 |
| **Conclusion** | Overall, the interventions in this study showed that the combined aerobic and resistance training protocol was effective at reducing diastolic blood pressure, increase lean body mass, strength and cardiorespiratory fitness. 2 Because of the results and subsequent effect on CVD risk factors, the authors were led to be confident in their conclusion that this combined program can help to reduce risk of CVD. 2 |
| **Title/Author/Year** | **Combined interval training and post-exercise nutrition in type 2 diabetes: A Randomized control trial**  Monique Francois, Cody Durrer, Kevin Pistawka, Frank Halperin, Courtney Change, Jonathan Little  July 25, 2017 |
| **Number of Subjects** | 53 participants |
| **Inclusion/Exclusion criteria** | **IC:** Type 2 diabetes, men and women between 40-75 yo, 12 lead stress test clearance3  **EC:** exogenous insulin users, diagnosed CVD and diabetes complications or contraindications to exercise3 |
| **Outcome Measures and Time Frame** | Continuous Gucose Monitoring (CGM), Body composition (waist circumference, heigh + weight), Cardiorespiratory fitness (VO2peak), Blood pressure and endothelial function (Flow mediated dilation, brachial artery dilatory capacity), QOL (SF-36) 3  12 week intervention period |
| **Description of Intervention** | All participants performed a supervised low-volume HIIT program 3dx12 weeks and were randomly prescribed one of three drinks (low-fat milk, macronutrient control or placebo) to take after exercise. 3 Cardio consisted of cycling, treadmill or elliptical at 58-90% HR max for 1min on/off cycles and resistance exercises using bands or multi- gym at an RPE of 5 on the CR-10 scale followed the 1min on/off cycles as well. 3 Participants started with 4 intervals then progressed 10 intervals in the first six weeks, the last 6 weeks consisted of 10 intervals. 3 |
| **Results** | Results of the study produced a significant reduction in mean 24h glucose, glycemic variability and HbA1c but fasting glucose was not significantly affected after 12 weeks of HIIT. 3 There was no significant difference between beverage groups however when it came to glycemic control. 3 Body mass was considered to be significantly lower after the 12 week HIIT program with lean body mass significantly increased. 3 VO2 peak significantly increased by 9.8% after the 12 week program and MAP was significantly reduced by 5.7 +/- 7 mmHg. 3 |
| **Conclusion** | Cardiorespiratory fitness and presence of type II diabetes is a predictor for cardiovascular mortality. 3 Because T2D and poor fitness or activity levels are risk factors for development or increased severity of CVD these authors found that a HIIT program, regardless of post-exercise beverage, positively affected the participants cardiovascular health and reduced risk factors that contribute to CVD. 3 The HIIT program was shown to improve glycemic control, blood pressure, cardiorespiratory fitness, body composition and endothelial function all of which are factors in cardiovascular health. 3 |
| **Title/Author/Year** | **Effect of 1 year of exercise training versus combined exercise training and weight loss on body composition, low grade inflammation and lipids in overweight patients with coronary artery disease: a randomized trial**  Lene Pedersen, Rsmus Olsen, Christian Anholm, Arne Astrup, Jesper Olsen, Mogen Fenger, Lene Simonsen, Rosemary Walzem, Steen Haugaard, & Eva Prescott  October 1, 2019 |
| **Number of Subjects** | 70 participants |
| **Inclusion/Exclusion criteria** | **IC:**  Stable CAD diagnosed > 6 months prior, age 45-75 years, BMI 28-40 kg/m24  **EC:**  Known diabetes, heart failure EF <35%, severe or moderate valve disease, main stem stenosis, arrhythmias, ischaemia, 2nd or 3r degree AV block, severe co-morbidity (chronic pulmonary disease, active cancer, severe kidney failure), weight loss or gain of 5% 3 months prior 4 |
| **Outcome Measures and Time Frame** | Body weight, body composition (whole-body dual x-ray absorptiometry scan), VO2 peak (CPET), HR, International Physical activity questionnaire short form (iPAQ-SF), Lipids and density profiling (Blood samples), BP, Hospital Anxiety and Depression Scale (HADS) 4  1 year intervention program |
| **Description of Intervention** | Participants were separated into aerobic interval training (AIT) or low energy diet (LED) and AIT groups. 4 The AIT group had 48min, 3x/12 week sessions consisting of 10 minute warmup (stairs/bike) HIIT (bike) at 85-90% VO2 peak and 17-18 Borg scale 1-4min activity followed by a 1-3 min break. 4 The LED +AIT group followed the same exercise plan but the first 8-10weeks they followed the Cambridge Weight Plan with 2-4 weeks transition to a maintenance diet for 40 weeks along with only 2 sessions of AIT. 4 |
| **Results** | After a year, both groups showed a decrease in their total cholesterol, non-HDL cholesterol triglycerides and inflammation. 4 Both groups lost a significant % body weight with LED+AIT > AIT, and the LED+AIT and AIT had overall improvement in VO2peak. 4 |
| **Conclusion** | For a patient population with CAD, dyslipidemia, insulin resistance and is overweight a combined exercise and diet intervention is key to achieving long term improvements in body composition and reducing severity of CAD. 4 Their intervention was able to show a decrease in abdominal obesity which is related to increased mortality in CAD as well as normalization of mRNA transcription in adipose tissue which is “related to improved insulin sensitivity in overweight, sedentary, and dysglycaemic” individuals. 4 Overall a “caloric and exercise based program can help to reduce cardiovascular and metabolic risk factors.” 4 |
| **Conclusion with respect to aerobic and strength training for a community CVD program:**  There is a superfluous amount of studies conducted with regards to the effect that aerobic exercise, strength training and combinations of the two have on CVD risk factors and the health of those who already are diagnosed with CVD. The primary effects of combined training programs are on reduction of BP, adipose tissue and overall increase in cardiovascular health which is beneficial to the patient population this intervention focuses on. 2,3,4 Seeing as CVD can be affected by multiple comorbidities, most notably type II diabetes, included is a study that looked at the effects of combined training on both CVD risk factors and metabolic factors seen in those with diabetes. 3 Based off of the positive results from these studies the program should incorporate a combined exercise program with aerobic and strength components for at minimum 8 weeks in duration. Ways in which to monitor patient progress during their program should consist of BP ratings, HR (with monitor during activity), and self report measures (IPAQ/SF-36). | |

**Intervention 2: Diet**

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| **Title/Author/Year** | **Comparison of the DASH (dietary approaches to stop hypertension) diet and a higher-fat DASH diet on blood pressure and lipids and lipoproteins a randomized controlled trial**  Sally Chiu, Nathalie Bergeron, Paul Williams, George Bray, Barbara Sutherland, Ronald Krauss  2016 |
| **Number of Subjects** | 36 participants |
| **Inclusion/Exclusion criteria** | **IC:** men and women >21 yo, average diastolic BP 80-95mmHg, systolic BP <160mmHg5  **EC:** use of nicotine products or drugs, hx of CAD, diabetes, use of meds/hormones that affect lipid metabolism or BP, use of dietary supplements within past 3 months unwillingness to refrain from alcoholic beverages during study, BMI >355 |
| **Outcome Measures and Time Frame** | Waist and hip circumference, body weight, % body fat (by bioimpedance), BP (in lab + given a portable cuff), Fasting plasma samples, total cholesterol, HDL cholesterol, Triglycerides, glucose levels5  13 week intervention period |
| **Description of Intervention** | Each of the 36 individuals were required to try each of the 3 diets for a 3 week period, then a 2 week “wash-out” period where each individual ate their own food before transitioning to the next diet. 5There was a control diet, a standard DASH diet and a higher-fat lower carbohydrate modification of the DASH diet (HF-DASH). 5 When each 3 week period was completed, the individuals spent 2 days in clinic for lab measurements. 5 |
| **Results** | The HF-DASH and DASH diets produced significant and similar results in terms of lowering BP. 5 With respect to lipids and lipoproteins the HF-DASH diet produced slightly better results with lower plasma triglycerides, large/medium VLDL concentration and higher LDL but both HF-DASH and DASH significantly reduced total cholesterol compared with the control diet. 5 |
| **Conclusion** | The authors wanted to determine if introducing full-fat dairy foods (total and saturated fats) and reduced carbohydrates to the traditional DASH diet could produce beneficial effects on BP and lipids/lipoprotein concentrations. 5 They found that the components that help to lower BP in the DASH diet were maintained in the HF-DASH diet by the similar BP results but that the HF-DASH diet did a slightly better job at reducing triglycerides, VLDL particles and no increase in total or LDL cholesterol levels. 5 This means that individuals may be able to take in more saturated fats as long as they limit carbohydrate intake (from juices/ other sugars). 5 |
| **Title/Author/Year** | **The Mediterranean-style diet pattern and mortality among mend and women with cardiovascular disease**  Esther Gracia, Fernando Artalejo, Teresa Fung, Shanshan Li, Walter Willett, Eric Rimm, Frank Hu  January 2014 |
| **Number of Subjects** | 17,415 total participants |
| **Inclusion/Exclusion criteria** | **IC:** Nonfatal CVD, stroke, probable ischemic heart disease (IHD), angina pectoris, coronary bypass, coronary angioplasty 6  **EC:** cerebrovascular pathology due to infection, trauma, malignancy6 |
| **Outcome Measures and Time Frame** | Food Frequency questionnaire, Alternate Mediterranean Diet (aMED) score, National Death Index, Baseline health questionnaire (age, weight, height, smoking status, parental hx of MI, menopausal status, hormone therapy, medication use) 6  Dietary questionaries were sent out every 2-4 years from 1980-2008 |
| **Description of Intervention** | Based off the FFQ and the aMED scores over the year, the authors were able to analyze the effect of a Mediterranean style diet in those with CVD compared to individuals who did not partake in that style of diet. 6 |
| **Results** | An inverse relationship between aMED score and all-cause mortality was found meaning the higher the aMED score there was a 7% reduction in mortality rates. 6 |
| **Conclusion** | The authors compared their longitudinal data to other studies that focused on the effects of the Mediterranean diet in those individuals with CVD. 6 However, data on lifestyle choices and activity levels were not included in the study. 6 Because the Mediterranean diet is associated with lower concentrations of inflammatory markers as well as endothelial dysfunction, weight loss, reduced BP and better total to HDL ratios the authors were able to support the theory that the Mediterranean diet may help to reduce all cause and CVD mortality. 6 These effects may be attributable to its incorporation of olive oil, omega 3-fatty acids, higher concentrations of fiber, and reduction in alcohol consumption. 6 |
| **Conclusions regarding Dietary Component of CVD community program:**  While diet is considered to be outside a physical therapist’s scope of practice, it is an important component of cardiovascular health. A Community program should include referral sources for individuals at risk for, or who are already diagnosed with, CVD that include registered dietitians and online resources from accredited associations like the AHA and CDC. These two studies provide dietary options for those looking to decrease their risk for CVD or better manage their CVD. The DASH diet and the Mediterranean diet have been shown to have beneficial effects on one’s cardiovascular health by incorporating more fiber, omega 3-fatty acids, olive oils and reduction in saturated fats and alcohol consumption. 5,6 These components have been shown to reduce triglycerides, total cholesterol levels and overall blood pressure which when increased contributes to poor cardiovascular health. 5,6 | |

**Intervention 3: Health Belief Model**

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| **Title/Author/Year** | **Effects of a comprehensive reminder system based on the health belief model for patients who have had a stroke on health behaviors, blood pressure, disability and recurrence from baseline to 6 months: a Randomized controlled trial**  Meng-Yao Wang, Meng-Jie She, Li-Hong Wan, Mia-Miao Mo, Zhen Wu, Li-Li LI, Susan Neidlinger  2020 |
| **Number of Subjects** | 174 total participants |
| **Inclusion/Exclusion criteria** | **IC:** hx of hypertension, hospitalization within 1 month from new ischemic stroke onset, ability to walk independently prior to stroke, Modified ranking scale (mRS) 0-3, mobile phone/access to phone for message service 7  **EC:** history of cardioembolic stroke, Wernicke’s aphasia, cognitive impairment, hx of severe liver disease, kidney disease or any known malignancy, transfer to other departments or hospitals7 |
| **Outcome Measures and Time Frame** | Health Promoting Lifestyle Profile II (low-salt diet, smoking abstinence, limiting alcohol use, BP checkup and medication adherence categories were added), BP, mRS (asses degree of disability) 7 |
| **Description of Intervention** | The control group was given health education considered standard including a stork prevention handout and phone call follow up at 1 week and 1 month post-discharge. 7 The intervention group was given the same health education initially but also the CRS-HBM program. 7 The CRS-HBM program incorporates “face to face and telephone follow-up health education, calendar handbook and weekly automated messages for 6 months after discharge.” 7 The goal of this program is to prompt patients to adopt lifestyle modifications (PA, low salt diet, med adherence, BP checkup, keep warm), prevent falls and remind them to visit OP clinics more regularly. 7 |
| **Results** | Compared to the traditional model of health education following stroke, the CRS-HBM showed better results at the 3 month and 6 month follow up in medication adherence, lowering BP by increasing the individual’s awareness and promoting physical activity through motivational interviewing. 7 |
| **Conclusion** | By following both the traditional health educated group and the CRS-HBM group, the authors were able to conclude that the CRS-HBM promotes adherence to better health behaviors for a longer period of time. 7 The traditional group showed improvement in behaviors and reduced BP and disability during the initial 3 month period but without the additional follow up calls and calendar reminders the individuals reverted back to less-healthy behaviors. 7 The CRS-HBM maintained multiple strategies for a longer period of time to more effectively improve individual’s health beliefs and health education. 7 |
| **Title/Author/Year** | **Educational intervention based on the health belief model to modify risk factors of cardiovascular disease in police officers in Iran: A quasi-experimental study** |
| **Number of Subjects** | 58 total participants |
| **Inclusion/Exclusion criteria** | **IC:** 25-55yo, 2 years as a police officer, at least 3 of these CVD risk factors: BMI >25 kg/m2, TG >200mg/dL, total cholesterol >200mg/dL, HDL-C <60mg/dL, fasting blood sugar (FBS) >101 mg/dL, SBP >121 mmHg, DBP >81 mmHg8  **EC:** diagnosis of coronary heart disease, receiving medical tx for heart or vascular disorders, diabetes, psychological disorders (major depression/PTSD), hx of stroke/cardiovascular surgery8 |
| **Outcome Measures and Time Frame** | Demographics (age/sex/marital status/military rank/years of service/smoking before recruitment/PA), Multidimensional health belief model scale (HBMS), International Physical Activity questionnaire (IPAQ), Height, weight, Lab tests (serum TG, HDL-c LDL-c) 8  Total of 5 weeks8 |
| **Description of Intervention** | During the 5 weeks of the intervention, participants met in person and were placed in a group of 8-12 for a 1.5 hours. Each session targeted a different theme, the first being global CVD stats and unhealth behaviors/risk factors. 8 The second session focused on perceived severity, the 3rd educated the individuals on perceived benefits and healthy lifestyle choices. 8 Session for focused on barriers to health education and health behaviors and the last session focused on improving self-efficacy. 8 |
| **Results** | Results for FBS and blood pressure did not significantly decrease although authors remarked that if the study continued they might have seen more significant trends. 8 Individual’s who were categorized as “high risk” initially were now considered to be “low-risk” at the 3 month follow up in terms of PA, HDL-C, BMI, and LDL-C. 8 |
| **Conclusion** | The authors concluded that the HBM applied to an education program may be effective at producing short term benefits for those at risk of CVD. 8 While BP and FBS was not significantly reduced, attitudes and behavioral changes seen in the sample were positive. 8 However the authors did note that this group of individuals may be more motivated than the general population due to the nature of their job. 8 |
| **Conclusions regarding the use of the Health Belief Model in a community based CVD program:**  Non-adherence to intervention programs is one of the biggest hurdle’s patients and therapists face. By incorporating the Health Belief Model into a CVD community program, patient’s adherence will hopefully improve, and they will have a better understanding of their condition. | |

1. Hollings M, Mavros Y, Freeston J, Fiatarone Singh M. The effect of progressive resistance training on aerobic fitness and strength in adults with coronary heart disease: A systematic review and meta-analysis of randomised controlled trials. *Eur J Prev Cardiol*. 2017;24(12):1242-1259. doi:10.1177/2047487317713329
2. Schroeder EC, Franke WD, Sharp RL, Lee D-C. Comparative effectiveness of aerobic, resistance, and combined training on cardiovascular disease risk factors: A randomized controlled trial. *PLoS ONE*. 2019;14(1):e0210292. doi:10.1371/journal.pone.0210292
3. Francois ME, Durrer C, Pistawka KJ, Halperin FA, Chang C, Little JP. Combined Interval Training and Post-exercise Nutrition in Type 2 Diabetes: A Randomized Control Trial. *Front Physiol*. 2017;8:528. doi:10.3389/fphys.2017.00528
4. Pedersen LR, Olsen RH, Anholm C, et al. Effects of 1 year of exercise training versus combined exercise training and weight loss on body composition, low-grade inflammation and lipids in overweight patients with coronary artery disease: a randomized trial. *Cardiovasc Diabetol*. 2019;18(1):127. doi:10.1186/s12933-019-0934-x
5. Chiu S, Bergeron N, Williams PT, Bray GA, Sutherland B, Krauss RM. Comparison of the DASH (Dietary Approaches to Stop Hypertension) diet and a higher-fat DASH diet on blood pressure and lipids and lipoproteins: a randomized controlled trial. *Am J Clin Nutr*. 2016;103(2):341-347. doi:10.3945/ajcn.115.123281
6. Lopez-Garcia E, Rodriguez-Artalejo F, Li TY, et al. The Mediterranean-style dietary pattern and mortality among men and women with cardiovascular disease. *Am J Clin Nutr*. 2014;99(1):172-180. doi:10.3945/ajcn.113.068106
7. Wang M-Y, Shen M-J, Wan L-H, et al. Effects of a comprehensive reminder system based on the health belief model for patients who have had a stroke on health behaviors, blood pressure, disability, and recurrence from baseline to 6 months: A randomized controlled trial. *J Cardiovasc Nurs*. 2020;35(2):156-164. doi:10.1097/JCN.0000000000000631
8. Saffari M, Sanaeinasab H, Jafarzadeh H, et al. Educational Intervention Based on the Health Belief Model to Modify Risk Factors of Cardiovascular Disease in Police Officers in Iran: A Quasi-experimental Study. *J Prev Med Public Health*. 2020;53(4):275-284. doi:10.3961/jpmph.20.095