Second Chance to Do It Right: How to Engage Providers and Patients in Cardiac Rehab?

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www.taubresearchgroup.ucsd.edu

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1

Disclosures

- Consultant to Sanofi, Novo-Nordisk, Novartis, Boehringer-Ingelheim, Amgen, Bayer, Medtronic, Edwards and Esperion
- Founder and Shareholder of Epirium Bio

Research Funding:

Grants:

- NIH R01 DK118278: (PI: Taub PR)
  - Impact of time-restricted feeding (TRF) on glucose homeostasis and mitochondrial function in patients with metabolic syndrome – The TIMET Study
- Department of Homeland Security Grant (PI: Taub PR)
- Hillblom Network Grant (PI: Taub PR)
- Dysautonomia International Grant (PI: Taub PR)
- Amgen Investigator Initiated Study (PI: Taub PR)

Clinical Trial Leadership:

- US National Lead/Steering Committee Member for: Study of Inclisiran to Prevent Cardiovascular (CV) Events in Participants With Established Cardiovascular Disease (VICTORION-2P). (Sponsor: Novartis; NCT05030428)
- US National Lead/Steering Committee Member for: A Double-blind, Randomized, Placebo controlled, Multicenter Study Assessing the Impact of Olpasiran on Major Cardiovascular Events in Patients with Atherosclerotic Cardiovascular Disease and Elevated Lipoprotein (a). (Sponsor: Amgen)

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Overview of Talk

- Review of current state of Cardiac Rehabilitation
- How COVID-19 has changed Delivery of Cardiac Rehabilitation
- New paradigms in Cardiac Rehabilitation and Future Directions
- Overview of Our Program at UC San Diego
- Expanding Scope of Cardiac Rehabilitation to Other Populations (POTS, CKD etc)

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Outcomes Associated with Cardiac Rehabilitation

- Meta-analysis of 34 randomized controlled trials showed that exercise-based CR programs are associated with:
  - A lower risk of re-infarction (OR 0.53; 95% CI: 0.38 to 0.76)
  - Decreased cardiac mortality (OR 0.64; 95% CI: 0.46 to 0.88)
  - Decreased all-cause mortality (OR 0.74; 95% CI: 0.58 to 0.95)
- CR reduces 90 day hospital readmission rate after acute MI or PCI
- Class IA recommendation by AHA/ACC Guidelines

Am J Med 2004;116:682–92.

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Currently Covered Indications for Cardiac Rehabilitation

- Heart attack
- Coronary artery bypass grafting (CABG)
- Chronic stable angina
- Cardiac transplantation
- Heart valve repair or replacement
- Stable, chronic heart failure (EF<35%)
- **Peripheral Arterial Disease**

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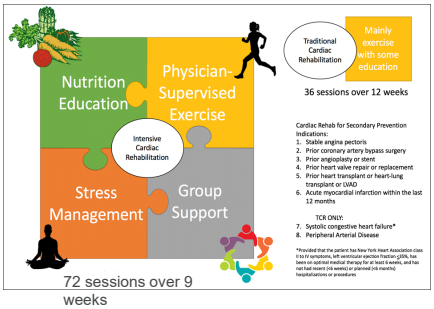
Overview of Cardiac Rehabilitation Programs



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Intensive Cardiac Rehab: Ornish Versus Pritikin

	Ornish	Pritikin
Total Number of Sessions covered 72 (max per day is 6 sessions) over 18 weeks	72 sessions (divided into 18 sessions that are 4 hours each)	72 sessions(can customize how many sessions per day)
Diet	100% plant based	Allows for lean meat and fish
Format	All with live instructors: 1 hour of exercise 1 hour of nutrition counseling 1 hour of yoga and 1 hour of group therapy Patients are in groups of 10-12 and stay with the same cohort throughout the program	Some parts are Video Instruction. Sessions duration can be customized over 18 weeks
Outcome Data	The Lifestyle Heart Trial showed significant regression of coronary atherosclerosis measured by angiography in the experimental group randomly assigned to intensive lifestyle changes. (5 year results reported by Ornish JAMA 1998)	Data from Pritikin residential treatment centers showed improvement in lipids, A1c, blood pressure and weight. (Barnard Am J Cardiol 1992)

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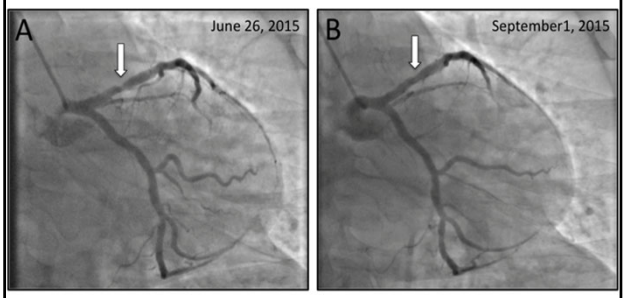
Case study of a patient from enrolled in Intensive Cardiac Rehabilitation Program



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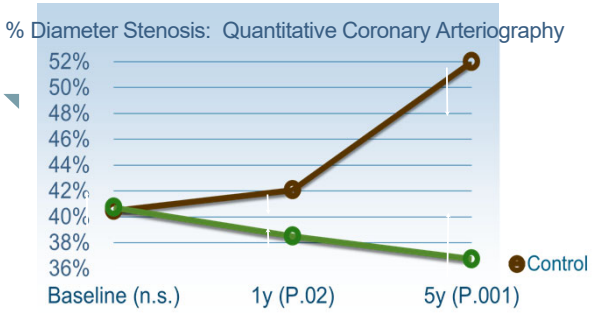
Lifestyle Heart Trial



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Ornish D et al. Lancet. 1990; 336:129 & JAMA. 1998;280:2001.

9

Barriers to Utilization of Cardiac Rehabilitation

- Fewer than 20% of all eligible patients participate in a CR
  - Of those who are referred to CR, only 34% actually enroll
    - Patients with physical disabilities are not referred as it is assumed they cannot participate in CR
- Factors contributing to poor utilization
  1) Lack of a centralized method for referral
  2) Inadequate communication among treatment teams, patients, and CR facilities
  3) Unfamiliarity with CR among potential referring physicians
  4) Limited access, and perceived inconvenience for the patient (e.g. copays and transportation)

Mazzini MJ et al n. Am J Cardiol. 2008;101(8):1084-7.

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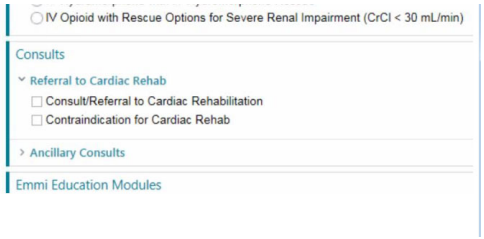
10

Automatic Referrals to CR via Electronic Medical Record



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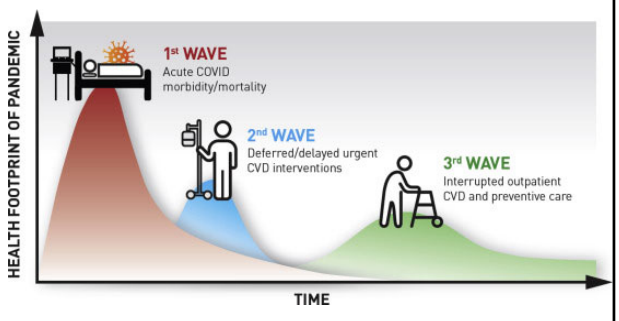
11

Impact of COVID-19 on Preventive Cardiovascular Care



Khera A et al. Continuity of care and outpatient management for patients with and at high risk for cardiovascular disease during the COVID-19 pandemic: A scientific statement from the American Society for Preventive Cardiology. Am J Prev Cardiol. 2020

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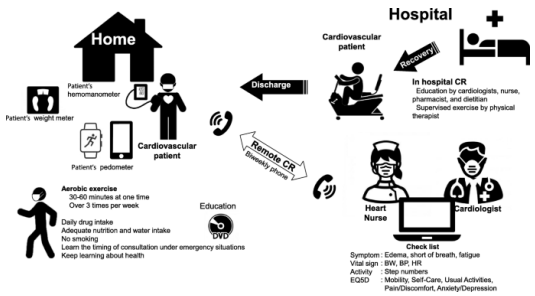
12

Models for Delivering Remote Cardiac Rehabilitation



Nakayama, A *et al.* Remote cardiac rehabilitation is a good alternative of outpatient cardiac rehabilitation in the COVID-19 era. *Environ Health Prev Med* **25,** 48 (2020).

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Hybrid Model of Cardiac Rehabilitation (Hybrid CR)

- Hybrid CR involves 1-2 initial sessions in the center followed by subsequent sessions completed remotely with home based monitoring
- Initial in-person sessions are to ensure safety and psychological wellbeing.
- CR delivered through the hybrid model results in similar improvement in functional capacity.
- Hybrid CR maybe to able to strike the balance between center based CR and home based CR

Imran Hafiz M. *et al.* Home-Based Cardiac Rehabilitation Alone and Hybrid With Center-Based Cardiac Rehabilitation in Heart Failure: A Systematic Review and Meta-Analysis. *J. Am. Heart Assoc.* **8**, e012779 (2019).

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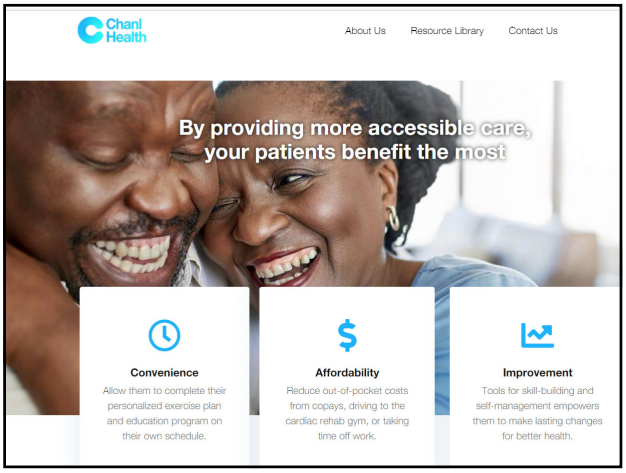
14



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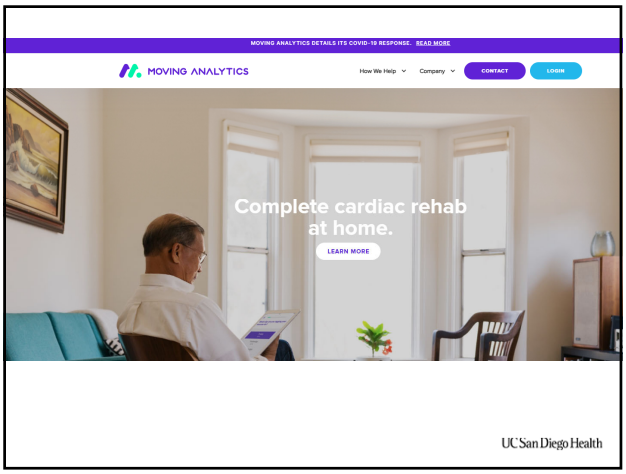

16

Barriers to implementation of Remote CR

- Digital Divide
- **Reimbursement**

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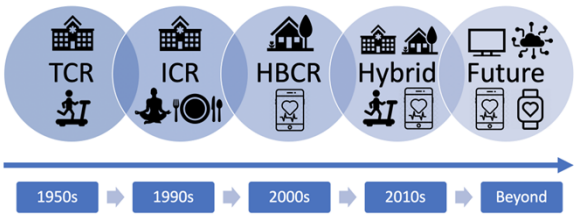
17

Evolution of Cardiac Rehabilitation



TCR = traditional cardiac rehabilitation (CR), ICR = intensive CR, HBCR = home-based CR

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New Paradigm For Cardiac Rehabilitation

- "Living Lab" for research and secondary prevention
- Ideal population to deploy new technologies to prevent readmission
  - Good outcome trials needed
- Using devices/wearables to expand the length and scope of cardiac rehabilitation

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19

Our Program at UC San Diego

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20

21

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21

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22

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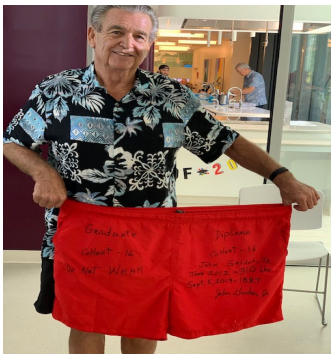
23



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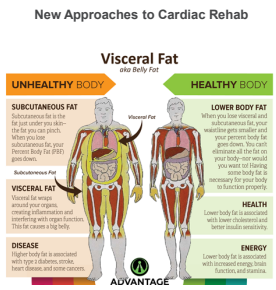
24



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25

Sports Med (2018) 48:269–288
https://doi.org/10.1007/s40279-017-0807-y

Cross

REVIEW ARTICLE

Effect of High-Intensity Interval Training on Total, Abdominal and Visceral Fat Mass: A Meta-Analysis

Florie Maillard[1] · Bruno Pereira[2] · Nathalie Boisseau[1,3]

Conclusion HIIT is a time-efficient strategy to decrease fat-mass deposits, including those of abdominal and visceral fat mass. There was some evidence of the greater effectiveness of HIIT running versus cycling, but owing to the wide variety of protocols used and the lack of full details about cycling training, further comparisons need to be made. Large, multicenter, prospective studies are required to establish the best HIIT protocols for reducing fat mass according to subject characteristics.

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26

nutrients MDPI

Article

Effectiveness of Intensive Cardiac Rehabilitation in High-Risk Patients with Cardiovascular Disease in Real-World Practice

Iwona Świątkiewicz [1,2,*], Salvatore Di Somma [3], Ludovica De Fazio [3], Valerio Mazzilli [3] and Pam R. Taub [1]

1 Division of Cardiovascular Medicine, University of California San Diego, La Jolla, CA 92037, USA; ptaub@ucsd.edu
2 Department of Cardiology and Internal Medicine, Nicolaus Copernicus University in Toruń, Collegium Medicum in Bydgoszcz, 85-094 Bydgoszcz, Poland
3 Department of Medical-Surgery Sciences and Translational Medicine, Sapienza University of Rome, 00189 Rome, Italy; salvatore.disomma@uniroma1.it (S.D.S.); defazio.1638453@studenti.uniroma1.it (L.D.F.); mazzilli.1626468@studenti.uniroma1.it (V.M.)
* Correspondence: iwona.swiatkiewicz@gmail.com

Abstract: Structured lifestyle interventions through cardiac rehabilitation (CR) are critical to improving the outcome of patients with cardiovascular disease (CVD) and cardiometabolic risk factors. CR programs' variability in real-world practice may impact CR effects. This study evaluates intensive CR (ICR) and standard CR (SCR) programs for improving cardiometabolic, psychosocial, and clinical outcomes in high-risk CVD patients undergoing guideline-based therapies. Both programs provided lifestyle counseling and the same supervised exercise component. ICR additionally included a specialized plant-based diet, stress management, and social support. Changes in body weight (BW), low-density lipoprotein cholesterol (LDL-C), and exercise capacity (EC) were primary outcomes. A total of 314 patients (101 ICR and 213 SCR, aged 66 ± 13 years, 75% overweight/obese, 90% coronary artery disease, 29% heart failure, 54% non-optimal LDL-C, 43% depressive symptoms) were included. Adherence to ICR was 96% vs. 68% for SCR. Only ICR resulted in a decrease in BW (3.4%), LDL-C (11.3%), other atherogenic lipids, glycated hemoglobin, and systolic blood pressure. Both ICR and SCR increased EC (52.2% and 48.7%, respectively) and improved adiposity indices, diastolic blood pressure, cholesterol intake, depression, and quality of life, but more for ICR. Within 12.6 ± 4.8 months post-CR, major adverse cardiac events were less likely in the ICR than SCR group (11% vs. 17%), especially heart failure hospitalizations (2% vs. 8%). A comprehensive ICR enhanced by a plant-based diet and psychosocial management is feasible and effective for improving the outcomes in high-risk CVD patients in real-world practice.

check for updates

Citation: Świątkiewicz, I.; Di Somma, S.; De Fazio, L.; Mazzilli, V.; Taub, P.R. Effectiveness of Intensive Cardiac Rehabilitation in High-Risk Patients with Cardiovascular Disease in Real-World Practice. *Nutrients* **2021**, *13*, 3803. https://doi.org/10.3390/nu13313803

Academic Editor: Karolina Szewczyk-Golec

27

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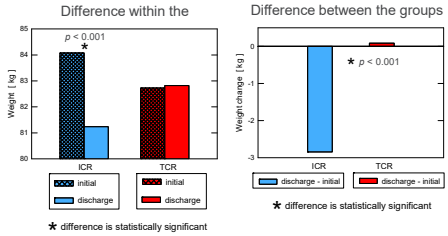
27

Weight



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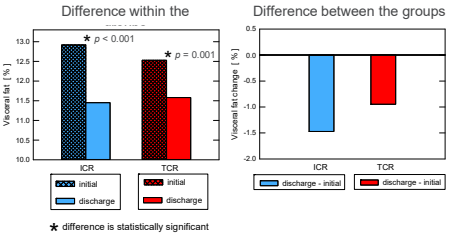
28

Visceral fat



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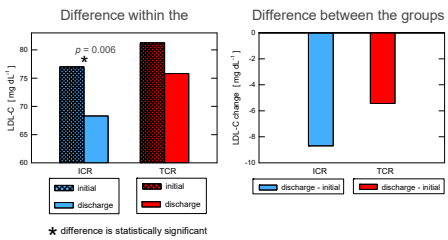
29

Low-density lipoprotein cholesterol (LDL-C)



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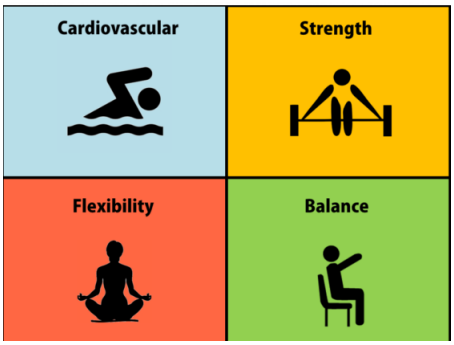
30

Diversity in Exercise Regimen



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31

Risk Assessment for Physical and Emotional Disabilities

- Exercise programs needs to personalized to the unique needs of the individual
- Assess for physical (including vision, hearing) and emotional disabilities (e.g. apprehension to exercise after myocardial infarction)
- Physical disabilities may not be apparent (e.g. peripheral neuropathy, balance issues, POTS etc.)
- Need to have appropriate safety measures in place

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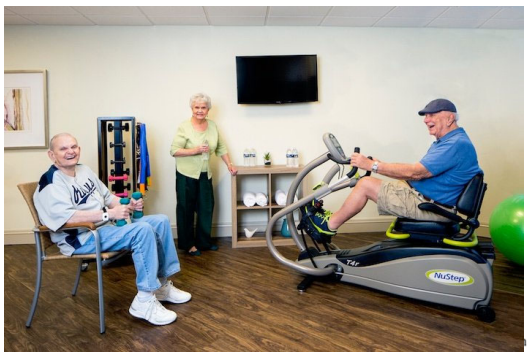
Exercise Programs can be Adapted for the Frail and Elderly



33

Example of Exercise Equipment that Patients with Disabilities and Impaired Mobility can Use

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34

35

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Physical Rehabilitation for Older Patients Hospitalized for Heart Failure

D.W. Kitzman, D.J. Whellan, P. Duncan, A.M. Pastva, R.J. Mentz, G.R. Reeves, M.B. Nelson, H. Chen, B. Upadhya, S.D. Reed, M.A. Espeland, L.A. Hewston, and C.M. O'Connor

ABSTRACT

BACKGROUND

Older patients who are hospitalized for acute decompensated heart failure have high rates of physical frailty, poor quality of life, delayed recovery, and frequent rehospitalizations. Interventions to address physical frailty in this population are

The auth
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Kitzman

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36

REHAB-HF Study Hypothesis

In frail, older patients hospitalized for ADHF, an innovative, early, transitional, tailored, progressive, multi-domain rehabilitation intervention that begins during hospitalization and continues for 3 months following discharge will improve physical function and reduce rehospitalizations

REHAB-HF
STRONG BODY – STRONG HEART

Slides from ACC 2021 Late Breakers (presented by Dr. Kitzman)

37

Innovative REHAB-HF intervention

- Designed specifically for older, **frail** patients hospitalized with ADHF
- Conducted 1:1 by a trained therapist
- Used a 16-cell grid with 4 performance levels for each of the 4 domains of physical function to i**ndividualize** the program to accommodate all levels of disability
- Specific exercises to progressively build in each domain
- Corrected balance, mobility, strength before endurance

REHAB-HF
STRONG BODY – STRONG HEART

Pastva et al, Contemporary Clinical Trials 2018, PMID: 29079391

38

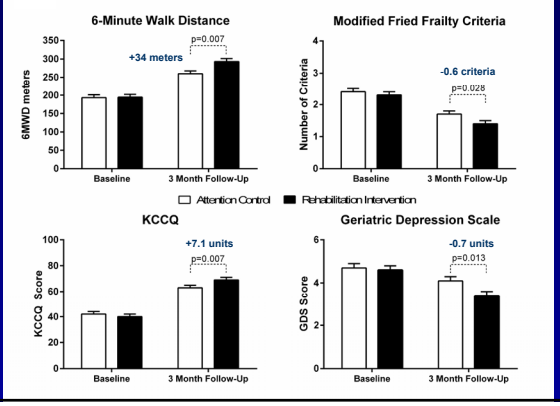
Innovative REHAB-HF intervention

- Began in hospital or as soon as possible thereafter
- Transitioned from hospital to outpatient facility to home
- Outpatient 3 times / week for 12 weeks
- Home exercise on non-facility days began after a home visit and evaluation of built environment
- After 12 weeks, transitioned to self-directed, home based

Pastva et al, Contemporary Clinical Trials 2018, PMID: 29079391

39

Other REHAB-HF 3-Month Outcomes



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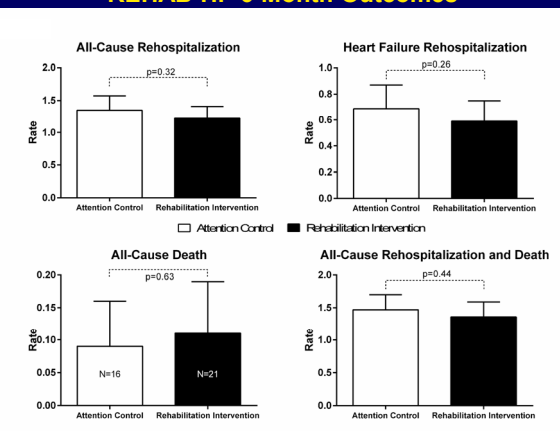
REHAB-HF 6-Month Outcomes



41

Summary of REHAB-HF Results

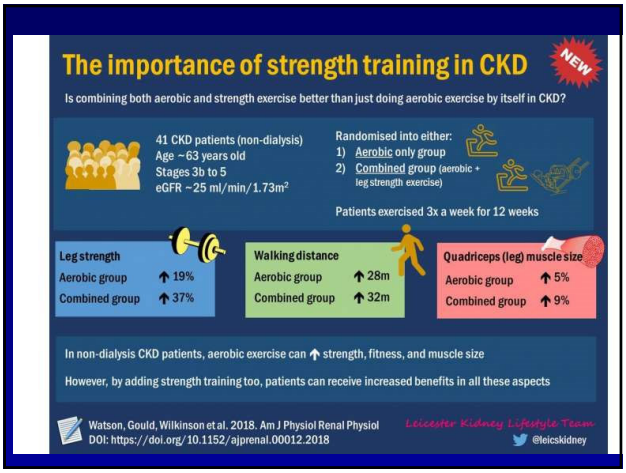
- Diverse, older population with high comorbidity burden
- Markedly impaired physical function and quality of life, and high rates of depression and frailty
- Intervention was feasible in both tertiary care and community hospital settings
- Excellent retention and intervention adherence

42

Summary of REHAB-HF Results

- The innovative intervention produced a large, significant improvement in SPPB that was relatively uniform across pre-specified subgroups
- Large improvements in 6-minute walk distance, quality-of-life, Fried Frailty score, and depression
- High rate of clinical events:
  - 1.17 rehospitalizations per patient over 6 months
  - 31% of patients had multiple hospitalizations
  - >10% died
- No statistically significant differences in rehospitalizations or death

43



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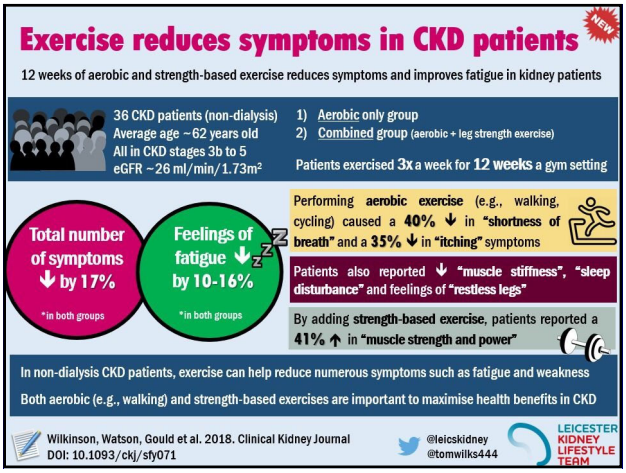

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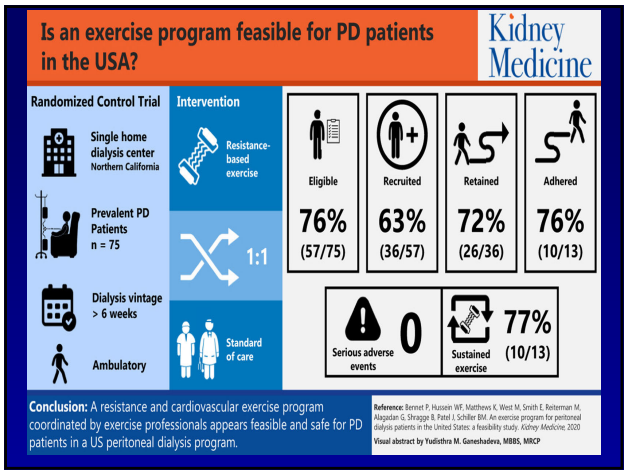
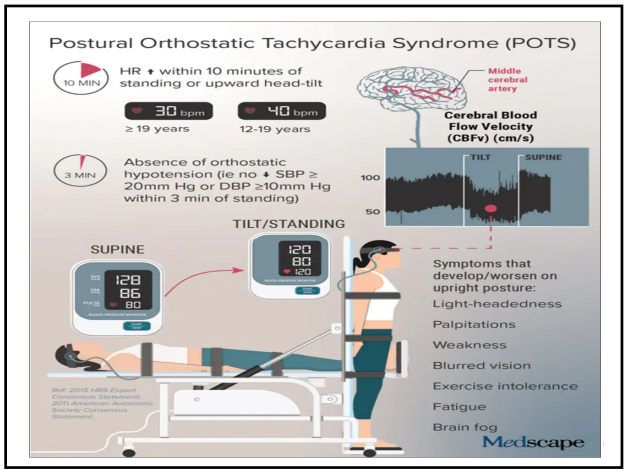
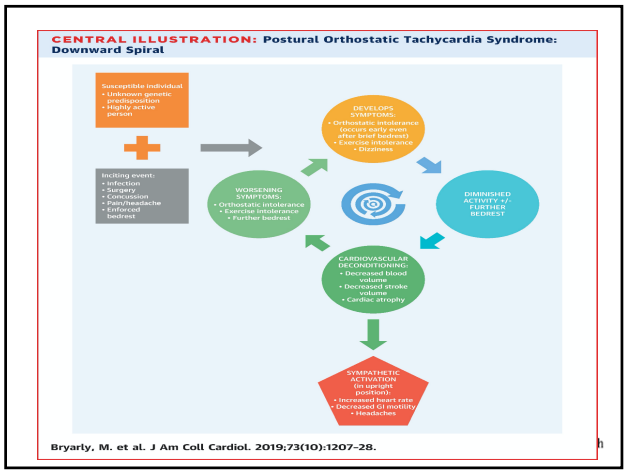

Is an exercise program feasible for PD patients in the USA?
Kidney Medicine
Randomized Control Trial
Single home dialysis center Northern California
Prevalent PD Patients n = 75
Dialysis vintage > 6 weeks
Ambulatory
Intervention
Resistance-based exercise
1:1
Standard of care
Eligible
76% (57/75)
Recruited
63% (36/57)
Retained
72% (26/36)
Adhered
76% (10/13)
Serious adverse events
0
Sustained exercise
77% (10/13)
Conclusion: A resistance and cardiovascular exercise program coordinated by exercise professionals appears feasible and safe for PD patients in a US peritoneal dialysis program.
Reference: Bernet P, Hussein WF, Matthews K, West M, Smith E, Reiterman M, Alagadan G, Shragge B, Patel J, Schiller BM. An exercise program for peritoneal dialysis patients in the United States: a feasibility study. Kidney Medicine. 2020
Visual abstract by Yudisthra M. Ganeshadeva, MBBS, MRCP

46


Postural Orthostatic Tachycardia Syndrome (POTS)
10 MIN
HR ↑ within 10 minutes of standing or upward head-tilt
30 bpm
≥ 19 years
40 bpm
12-19 years
3 MIN
Absence of orthostatic hypotension (ie no ↓ SBP ≥ 20mm Hg or DBP ≥10mm Hg within 3 min of standing)
Middle cerebral artery
Cerebral Blood Flow Velocity (CBFv) (cm/s)
TILT
SUPINE
100
50
TILT/STANDING
SUPINE
128
86
80
120
80
120
Symptoms that develop/worsen on upright posture:
Light-headedness
Palpitations
Weakness
Blurred vision
Exercise intolerance
Fatigue
Brain fog
Medscape

47


CENTRAL ILLUSTRATION: Postural Orthostatic Tachycardia Syndrome: Downward Spiral
Susceptible individual
• Unknown genetic predisposition
• Highly active person
Inciting event:
• Infection
• Surgery
• Concussion
• Pain/headache
• Enforced bedrest
DEVELOPS SYMPTOMS:
• Orthostatic intolerance (occurs early even after brief bedrest)
• Exercise intolerance
• Dizziness
DIMINISHED ACTIVITY +/- FURTHER BEDREST
CARDIOVASCULAR DECONDITIONING:
• Decreased blood volume
• Decreased stroke volume
• Cardiac atrophy
SYMPATHETIC ACTIVATION (in upright position):
• Increased heart rate
• Decreased GI motility
• Headaches
WORSENING SYMPTOMS:
• Orthostatic intolerance
• Exercise intolerance
• Further bedrest
Bryarly, M. et al. J Am Coll Cardiol. 2019;73(10):1207-28.

48

The international POTS registry: Evaluating the efficacy of an exercise training intervention in a community setting

Stephen A. George, MD, PhD,[*] Tiffany B. Bivens, MS,[†] Erin J. Howden, PhD,[*†] Yasir Saleem, MD,[*] M. Melyn Galbreath, PhD,[†] Dianne Hendrickson, MS, APRN, FNP-C,[†] Qi Fu, MD, PhD,[*†] Benjamin D. Levine, MD[*†]

From the [*]Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, Texas, and [†]Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas, Dallas, Texas.

CONCLUSIONS A training/lifestyle intervention program can be implemented in a community setting with physician supervision and is effective in the treatment of POTS. It remains to be determined whether exercise can be an effective long-term treatment strategy for this condition, though patients are encouraged to maintain an active lifestyle indefinitely.

49

Table 2 Short-term exercise training program

Training type	Month 1	Month 2	Month 3
Base pace (RPE 13–15)	10 × 30 min	6 × 30 min 3 × 35–40 min	5 × 35 min 4 × 45–60 min
Maximal steady state (RPE 16–18)	1 × 20 min 1 × 25 min	1 × 25 min 1 × 30 min 1 × 35 min	1 × 30 min 1 × 35 min 1 × 40 min
Recovery (RPE 6–12)	2 × 40 min	1 × 40 min 1 × 30 min	3 × 25 min
Strength training	8 × 15–20 min	8 × 20–25 min	8 × 30 min
Cardiovascular modes	Recumbent bike Swimming Rowing	Month 1 modes plus upright bike	Month 1 and 2 modes plus elliptical and treadmill walking

RPE = rating of perceived exertion (subjective rating of the entire cardio workout on a scale of 6–20: 6 is very, very easy; 11 is fairly easy; 13 is somewhat hard; 15 is hard; 17 is very hard; 19 is very, very hard).

50

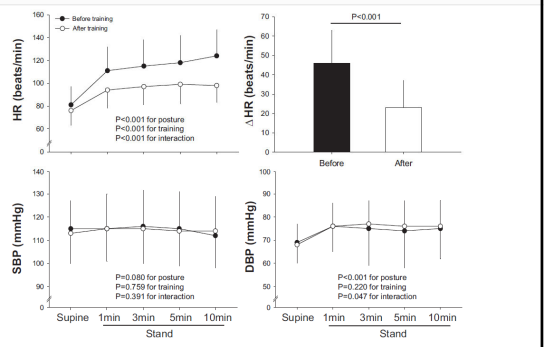
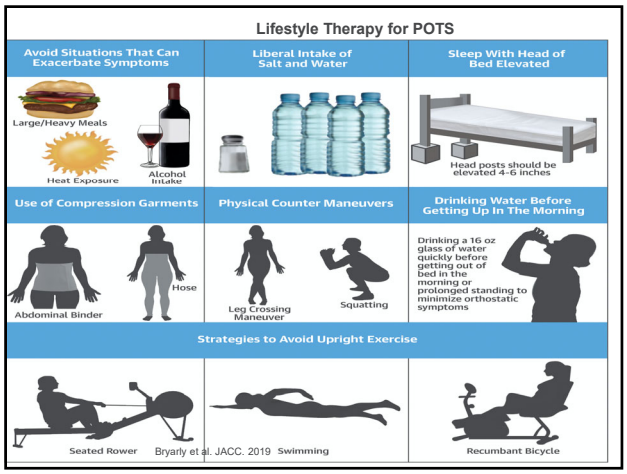
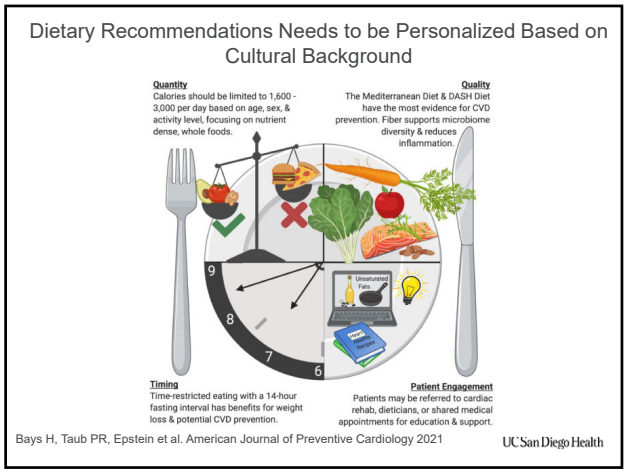


Figure 2 Effects of short-term exercise training on heart rate and blood pressure in the supine position and during 10-minute stand. HR = heart rate; ΔHR = change in heart rate from supine to 10-minute stand; SBP = systolic blood pressure; DBP = diastolic blood pressure.

51


Lifestyle Therapy for POTS
Avoid Situations That Can Exacerbate Symptoms
Large/Heavy Meals
Heat Exposure
Alcohol Intake
Liberal Intake of Salt and Water
Sleep With Head of Bed Elevated
Head posts should be elevated 4-6 inches
Use of Compression Garments
Abdominal Binder
Hose
Physical Counter Maneuvers
Leg Crossing Maneuver
Squatting
Drinking Water Before Getting Up In The Morning
Drinking a 16 oz glass of water quickly before getting out of bed in the morning or prolonged standing to minimize orthostatic symptoms
Strategies to Avoid Upright Exercise
Seated Rower
Swimming
Recumbant Bicycle
Bryarly et al. JACC. 2019

52


Dietary Recommendations Needs to be Personalized Based on Cultural Background
Quantity
Calories should be limited to 1,600 - 3,000 per day based on age, sex, & activity level, focusing on nutrient dense, whole foods.
Quality
The Mediterranean Diet & DASH Diet have the most evidence for CVD prevention. Fiber supports microbiome diversity & reduces inflammation.
Timing
Time-restricted eating with a 14-hour fasting interval has benefits for weight loss & potential CVD prevention.
Patient Engagement
Patients may be referred to cardiac rehab, dieticians, or shared medical appointments for education & support.
Bays H, Taub PR, Epstein et al. American Journal of Preventive Cardiology 2021
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53

CARDIOMETABOLIC
JACKPOT
Food Content (diet)
Calories Consumed
Duration of Caloric Consumption
Meal Frequency
WILD CARD
Mediterranean
Keto
Vegan
>3000
1000-1500
2000-2500
Genetics
Exercise
Level of Stress
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54

Conclusions

- Lifestyle approaches such cardiac rehabilitation and can decrease CV risk.
- These strategies are synergistic with device and pharmacotherapy.
- New era in preventive cardiology ushered in by shift to value based care.

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55

Heart Disease is Preventable

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56

57