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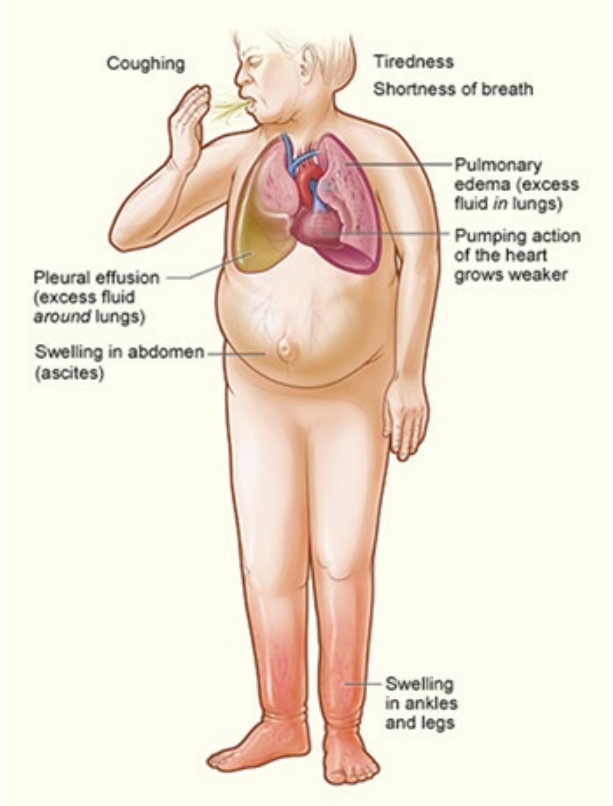
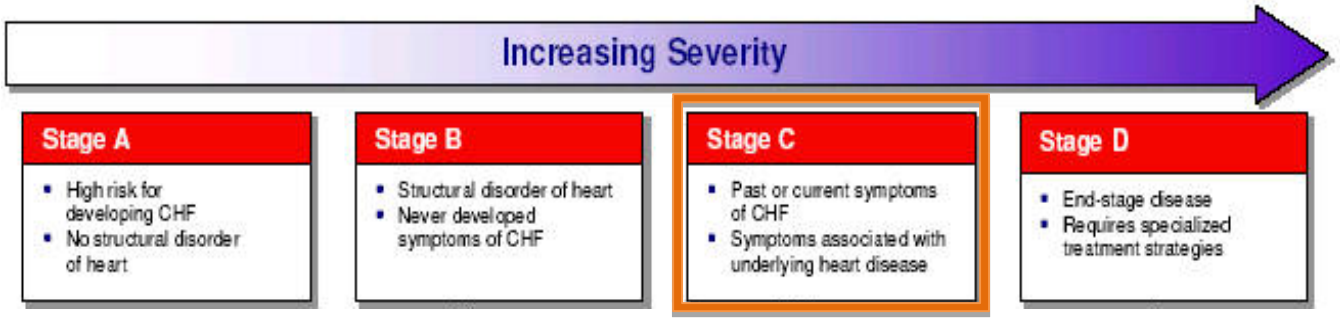
RCT in Patients with Heart Failure: Moderate Exercise on Mood and Cognitive Function

Laura Redwine, PhD
Associate Professor
University of South Florida
College of Nursing

Heart Failure

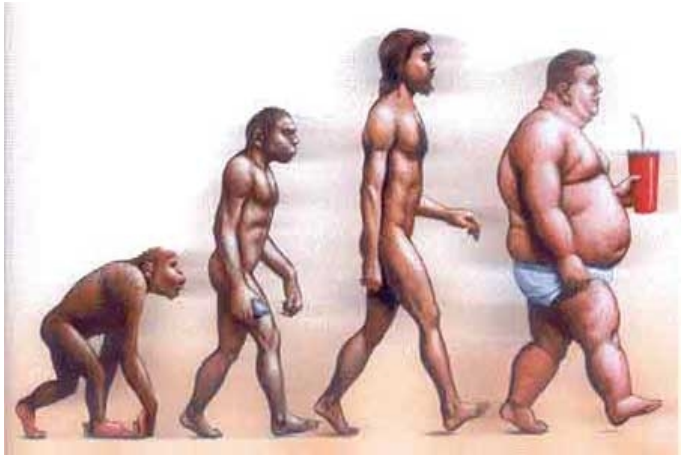
- **Often a final phase of CVD resulting from a variety of CV anomalies.**
- **Between 5 and 6 million North Americans are affected by HF**
- **88% of HF patients are over the age of 65**
- **Half of people with HF die within 5 years of diagnosis**





~~Seven~~ 8 key health factors and behaviors that impact health – Modifiable risk factors

- Smoking,
- Physical inactivity
- Poor diet,
- Overweight, obesity
- Control of cholesterol,
- Blood pressure
- Blood sugar
- Psychological Health



Comorbid depressive disorders are present in up to 40% of patients with HF ***(e.g. Rutledge et al, 2006)***

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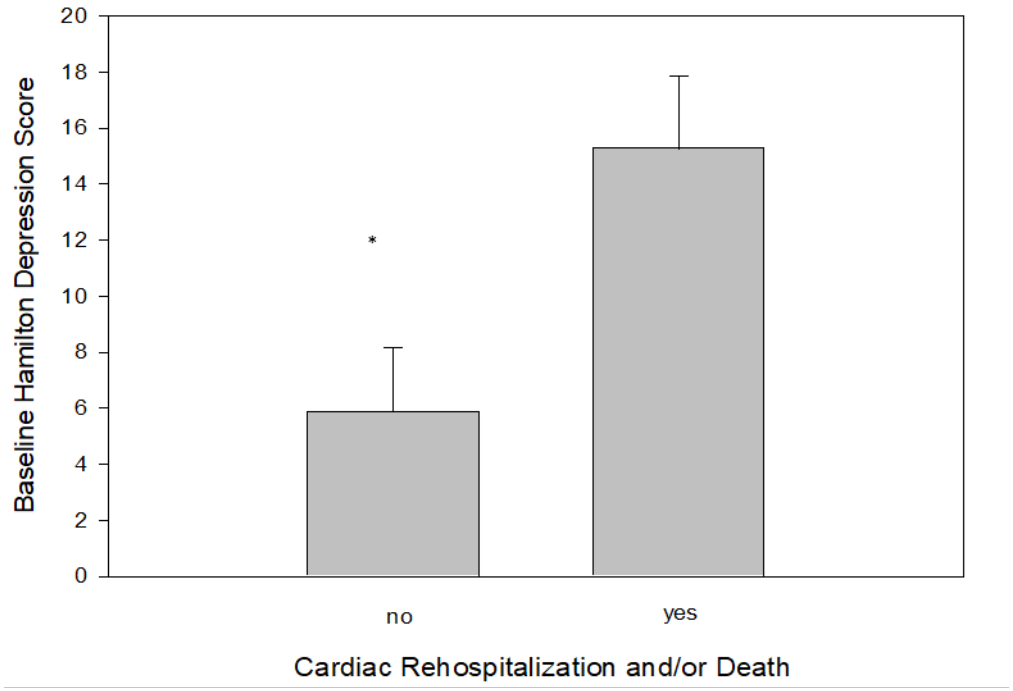
Depression symptoms predicted cardiac rehospitalization/death over a 2 - year period



Redwine et al, 2007 *Psychosom Med*

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Research suggests traditional cardiac rehabilitation can lower depressive symptoms in patients with HF ***(Blumenthal et al., 2012; Tu et al., 2014).***

Meta-Analysis of Exercise Studies and HF

HF and aerobic exercise interventions	Duration (months)	N (Exercise/ Control)	% men	Mean age	EF measure
Belardinelli et al., 1999	14	50/46	89	55	echo
Hambrecht et al., 2000	6	36/37	100	54	echo
McKelvie et al., 2002	12	90/91	81	65	radionuclide ventriculography
Myers et al., 2002	2	12/12	83	55	cardiac magnetic resonance imaging
Giannuzzi et al., 2003	6	45/46	100	60	echo
Sabelis et al., 2004	6.5	16/13	100	60	echo
Klocek et al., 2005	6	28/14	100	56	echo
Jonsdoittir et al., 2006	5	21/22	79	68	echo
Passino, et al., 2006	9	44/41	87	60	Not reported

Haykowsky et al, 2007; JACC

The HF-ACTION study median age = 59 years and excluded patients with exercise limitations and/or devices that limited the ability to achieve target heart rates *(O'Connor et al., 2009)***.**

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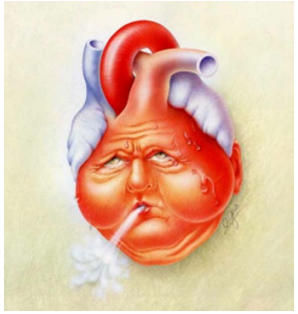
Meanwhile…



- 88% of HF patients are over the age of 65
- Many patients with HF have co-morbidities e.g. sarcopenia, anemia, obesity, diabetes, COPD, peripheral artery disease
- Definition of Heart Failure includes *exercise intolerance* and *exercise adherence is very LOW (Barbour et al, 2008)*
- Home-exercise walking studies: less than half of HF patients are eligible *(Jolly et al, 2007); barriers include weather and neighborhood safety*

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Tai Chi

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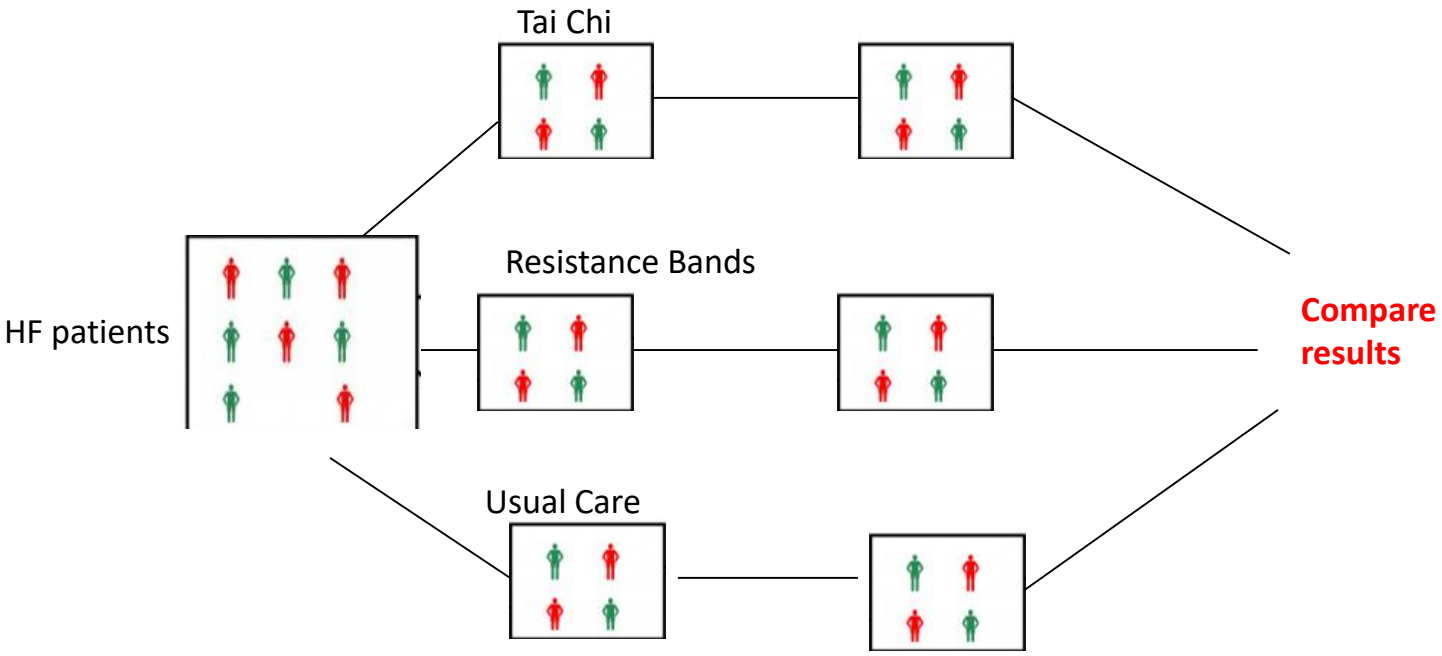
Resistance Band Training

Methods

70 Stage C HF patients randomized to 16 weeks of Tai Chi, Resistance Bands and usual care



- **Beck Depression Inventory II (clinically significant scores ≥ 10)**
- **%LVEF**
- **6-minute walk test**
- **Montreal Cognitive Assessment (MoCA) (Mild Cognitive Impairment ≤ 24**

Participant Characteristics

Baseline Subject Characteristics					
	Total	TC	RB	TAU	P
N	70	25	22	23	value
Age (years)	66 (10)	64 (8)	67 (9)	67(12)	.47
Education (% college)	41	10	18	13	.17
Sex (% male)	90	94	93	84	.58
Race (% white)	64	62	80	53	.55
LVEF	45(13)	43 (11)	46(16)	46 (12)	.85
HFpEF (%)	36	31	40	37	.88
BMI (kg/m^2)	32(8)	31(8)	33(9)	31(7)	.84
BDI score	10(6)	10 (6)	12 (7)	8 (6)	.17
MoCA score	24(3)	24(3)	23(4)	25(2)	.22
Log CRP (mg/dl)	2.5(1.1)	2.8(1.3)	2.4(.7)	2.3(1.2)	.47
Log IL-6 (pg/ml)	.24(.6)	.24(.6)	.41(.6)	.11(.6)	.53
Log TNFa (pg/ml)	1.1(.4)	1.2(.3)	1.1(.5)	1.0(.2)	.11

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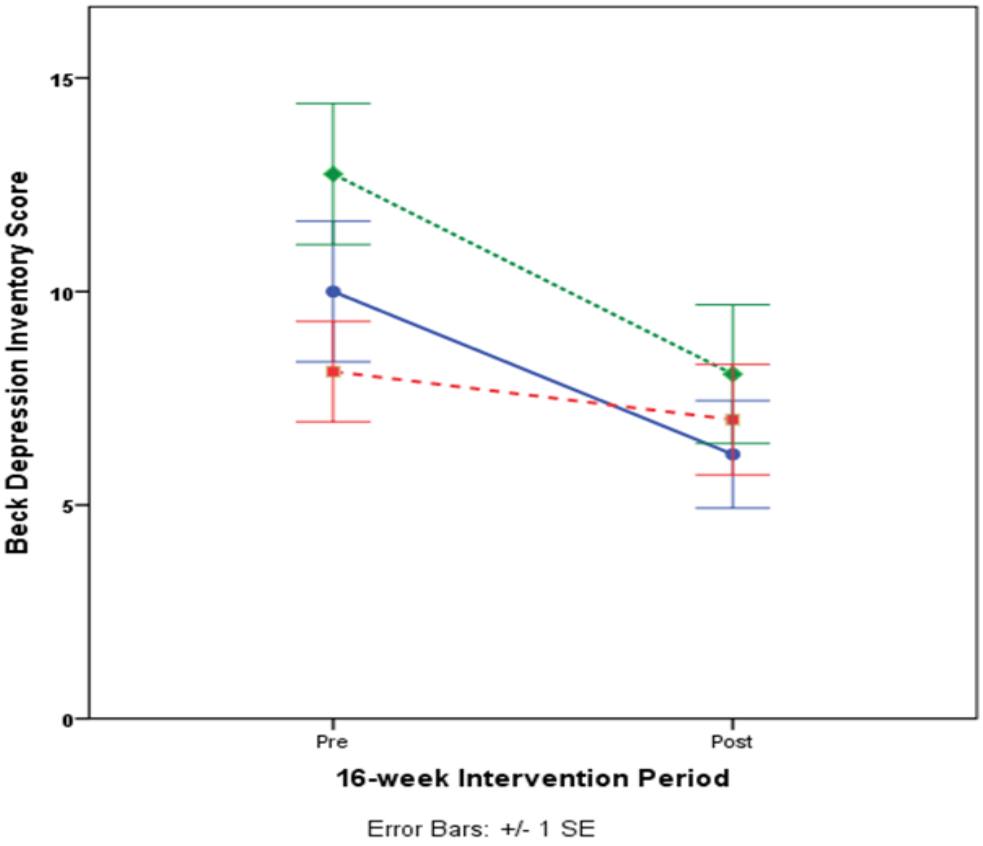
Treatment fidelity and adherence

- 16% dropped out (TC: n = 4; RB: n = 3; TAU: n = 4)
- TC participants attended a median of 87% of classes (median = 28 sessions) and practiced a median of 74 min/wk.
- RB group attended a median of 81% of classes (median = 26 classes) and practiced a median of 61 min/wk.
- There were no differences in age, gender, %LVEF, 6MWT, HFpEF or HFrEF sub-types, BDI scores between those who dropped out from those who completed the study
- There were no serious adverse events associated with the study.

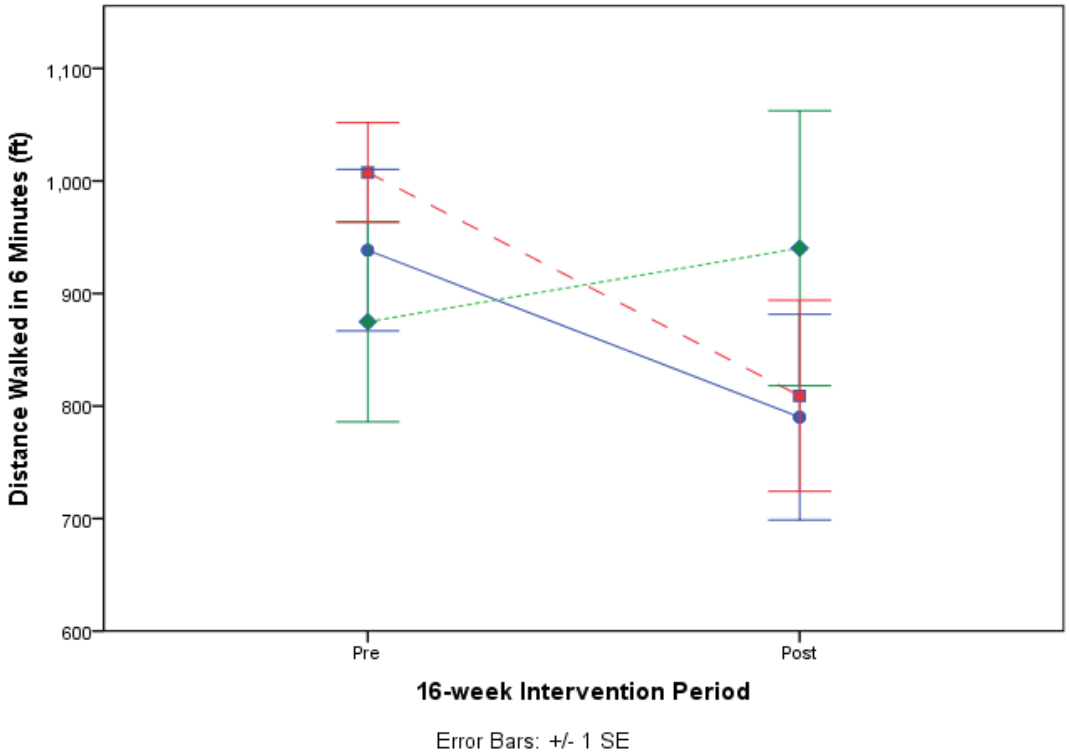
Depression Scores: Tai Chi, RB and TAU Groups



Measures at baseline and after 16- week intervention period.

Changes in BDI scores (means + sem): tai chi (TC) (blue) resistance band (RB)(green) exercise or treatment as usual (TAU) controls (red).

6 min walk test: Tai Chi, RB and TAU Groups



Measures at baseline and after 16- week intervention period.

Changes in 6MWT (means + sem): tai chi (TC) (blue) resistance band (RB)(green) exercise or treatment as usual (TAU) controls (red).

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Summary

- **Mild to Moderate Exercise (Tai Chi and RB) associated with reduced depression symptoms**
- **RB appeared to avoid the reduction in physical function (6MWT)**
- **Global implications: Tai Chi and RB, requires no equipment, can be implemented in local clinics, community centers and practiced at home.**

Redwine et al, 2019 Journal of Cardiopulmonary Rehabilitation and Prevention

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Heart Failure and Mild Cognitive Impairment (MCI)

- Around 50% of patients with heart failure exhibit MCI *e.g. Alagiakrishnan et al, 2017*
- MCI increases risk of dementia with an annual conversion rate of 10–15% *(Espinosa et al, 2013)*.
- Cognitive Impairment impacts self-care *(Davis et al, 2014)*
- Greater depressive symptom severity is associated with worse cognitive performance *(Alosco et al, 2013; Hawkins et al, 2015)*
- Predicts repeat hospitalizations and is associated with a 5-fold increase in mortality rate *(Hajduk et al, 2013)*

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Physical activity and Cognitive Function

- Physical activity of at least moderate intensity, e.g. aerobic exercise, resistance training and Tai Chi reduces risk of cognitive impairment *(Northey, Cherbuin, Pumpa, Smee, & Rattray, 2018).*

- Gaps in research: little is known about effects of physical activity and cognitive function in HF patients

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Questions

- Do Tai Chi and/or Resistance exercise improve scores on the MoCA?
- In response to moderate exercise training, do changes in depression predict altered cognitive function?

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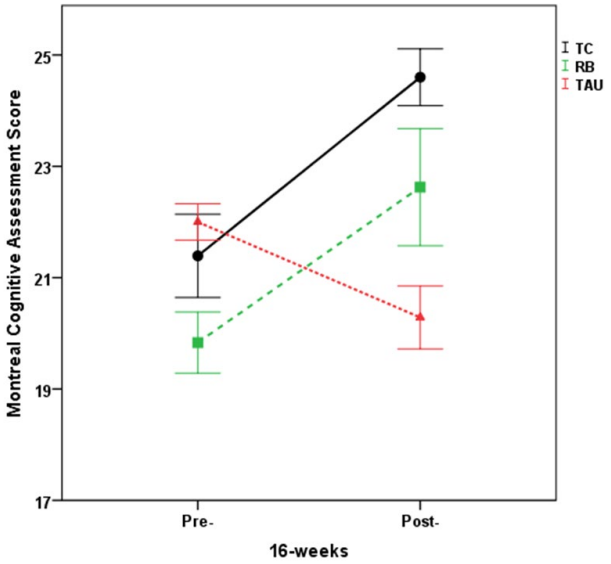
Tai Chi, RB and Treatment as Usual on Cognitive Function

		TC	RB	TAU
MoCA*	pre	24.3 (3)	22.9 (4)	24.7 (2)
	post	25.2 (3)	24.9 (4)	23.6 (3)
BDI*	pre	9.6(6)	11.9 (7)	8.0 (6)
	post	6.1 (5)	8.6 (6)	7.0 (6)
Log CRP	pre	2.8 (1.3)	2.4 (.7)	2.3 (1.2)
	post	2.9 (1.5)	2.4 (.9)	2.4 (1.3)
Log IL-6	pre	.24 (.64)	.37 (.57)	.11 (.64)
	post	.48 (.77)	.31 (.82)	.11 (.54)
Log TNFa	pre	1.1 (.39)	1.2 (.34)	.97 (.20)
	post	1.2 (.33)	1.2 (.51)	.99 (.22)

Post-hoc analyses showed improvements with Tai Chi or RB in those with low MoCA scores (<24).



Decreases in depression symptoms over time were related to increases in cognitive function scores

Linear Regression: Dependent variable = MoCA post-intervention			
	deltaR^2	Beta	P
MoCA pre	.27	.517	.000
BDI pre	.018	.134	.294
BDI post	.18	-.695	.000
MoCA pre	.27	.52	.001
IL-6 pre	.08	.28	.06
IL-6 post	.02	.18	.34
MoCA pre	.27	.517	.001
TNFa pre	.000	-.097	.56
TNFa post	.000	.020	.94
MoCA pre	.27	.517	.002
CRP pre	.061	.248	.102
CRP post	.095	-.514	.034

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Summary

- Moderate exercises such as Tai Chi and RB interventions have implications for global reach to prevent cognitive decline in patients with HF

- Moderate exercise is acceptable to HF patients and evidence-based practices may consider recommending moderate exercise to improve the care and outcomes of cardiovascular patients.

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Limitations

- Modest sample size
- Lack of inclusion of important covariates
- Unable to examine differences between HFpEF and HFrEF
- Lack of measures for range of motion and exercise progression
- Small number of women, since most were recruited from the Veterans hospital

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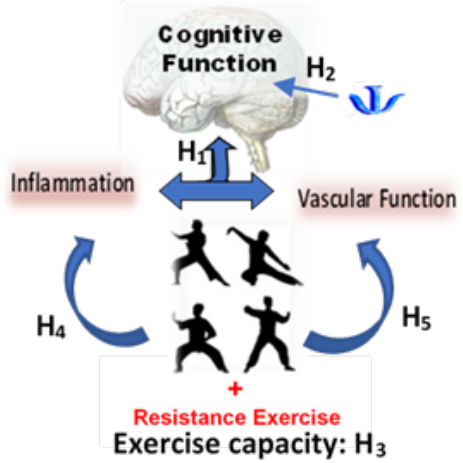
Future Directions

- **Primary Aim.** To compare rTC vs education for changes cognitive function (CF).
- **Secondary Aim1.** To assess depressive symptoms and exercise capacity in response to rTC vs education as potential mediators of changes in CF.
- **Secondary Aim2.** To examine inflammation and vascular endothelial function in response to rTC vs education as potential mediators of changes for CF.
- **Exploratory Aim:** Path analysis. Relationships will emerge among the Primary and Secondary Aims



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Questions?