HFpEF : la réadaptation marche-t-elle aussi bien?

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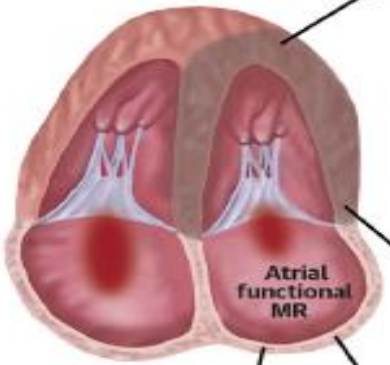
Conflits d’intérêts

Pas de conflits d’intérêt avec cette présentation

Conflits d’intérêt des 5 dernières années

- Astra Zeneca
- Novartis
- Sanofi
- Servier
- We Health

HFpEF



LV Pathology

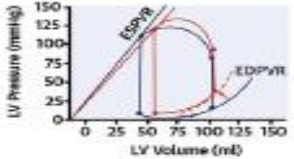
Triggers

- Aging
- Hypertension
- Obesity
- Diabetes
- Coronary microvascular disease

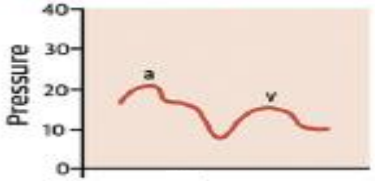
Cellular and Chamber Phenotypes

- Myocyte thickening, fibrosis
- Changes in LV geometry (concentric hypertrophy)

LV Hemodynamics



LA Hemodynamics



LA Pathology

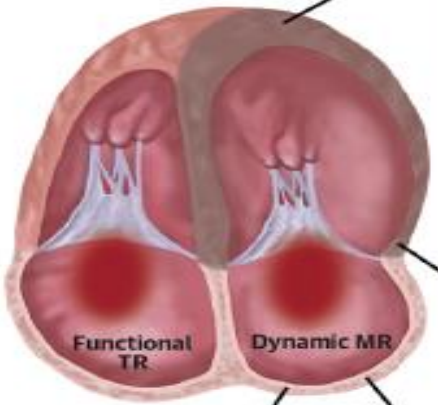
Triggers

- Atrial fibrillation, left atrial MR

Cellular and Chamber Phenotypes

- Pro-inflammatory activity, fibrosis, stiffness

HFrEF



LV Pathology

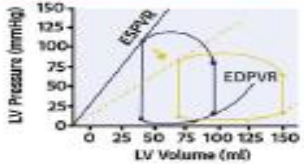
Triggers

- Ischemic heart disease
- Dilated cardiomyopathy
- Secondary mitral insufficiency

Cellular and Chamber Phenotypes

- Myocyte elongation
- Loss of LV compliance
- Changes in LV geometry (dilation and eccentric hypertrophy)

LV Hemodynamics



LA Pathology

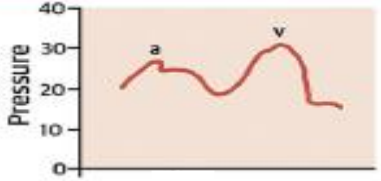
Triggers

- Dynamic MR, atrial myopathy

Cellular and Chamber Phenotypes

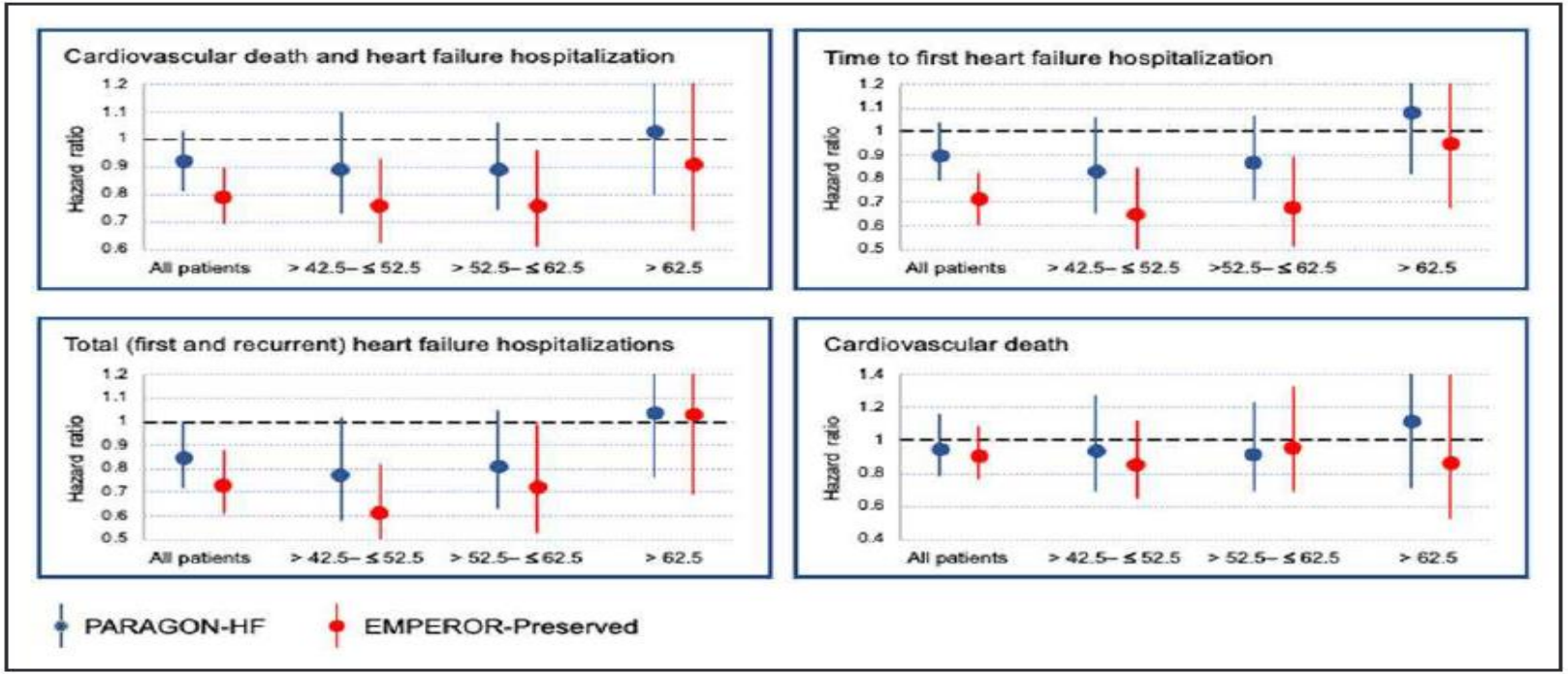
- LA enlargement, eccentric hypertrophy and loss of compliance

LA Hemodynamics



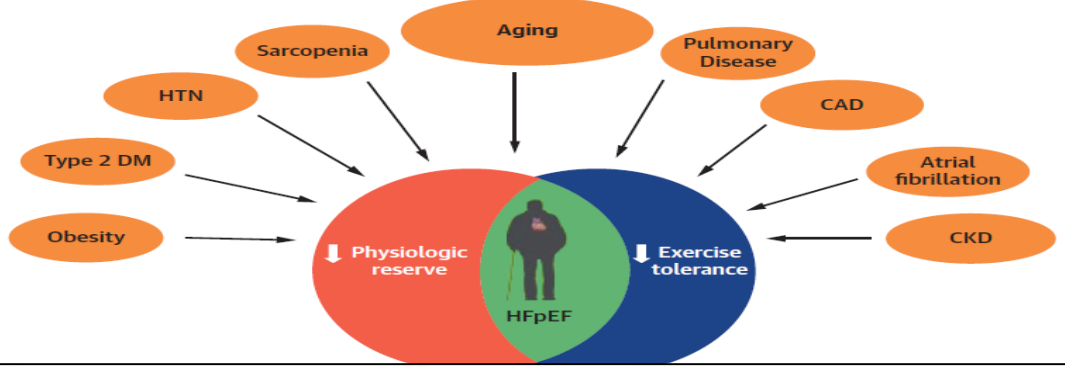
Guazzi, M. et al. J Am Coll Cardiol. 2020;76(9):1102-11.

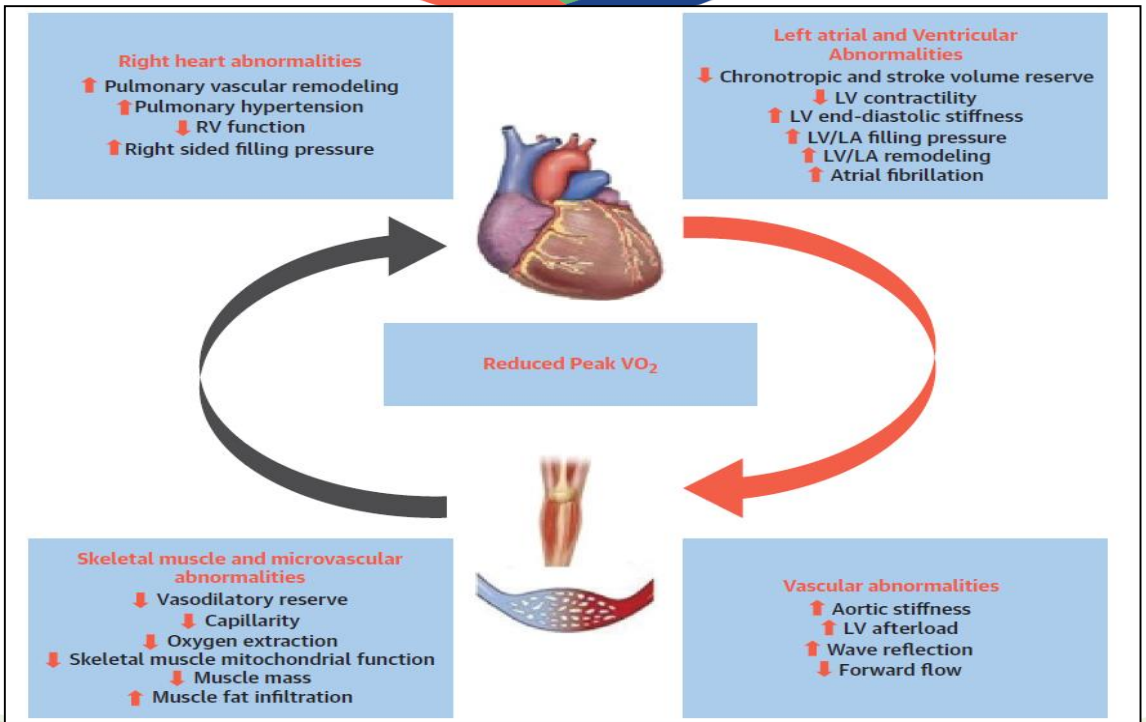
Traitement médical?



ARNI **Empaglifozine**

Packer M. Circulation 2021,144:1193-95


Aging
Sarcopenia
Pulmonary Disease
HTN
CAD
Type 2 DM
Atrial fibrillation
Obesity
CKD
Physiologic reserve
Exercise tolerance
HFpEF


Right heart abnormalities
Pulmonary vascular remodeling
Pulmonary hypertension
RV function
Right sided filling pressure
Left atrial and Ventricular Abnormalities
Chronotropic and stroke volume reserve
LV contractility
LV end-diastolic stiffness
LV/LA filling pressure
LV/LA remodeling
Atrial fibrillation
Reduced Peak VO_2
Skeletal muscle and microvascular abnormalities
Vasodilatory reserve
Capillarity
Oxygen extraction
Skeletal muscle mitochondrial function
Muscle mass
Muscle fat infiltration
Vascular abnormalities
Aortic stiffness
LV afterload
Wave reflection
Forward flow

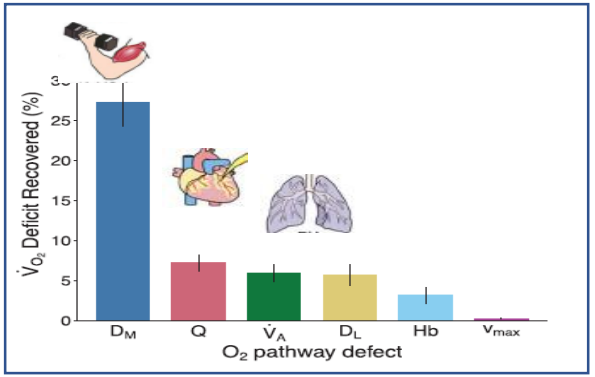
HFpEF: Mechanisms of exercise intolerance

1. LV remodelling
2. Chronotropic incompetence
3. Diastolic dysfunction

Central modifications

4. Impaired peripheral vascular function
5. Skeletal Muscle factors
6. Abnormal ventilatory /respiratory function

Peripheral changes



Farris S. Heart Fail Rev. 2017;22:141-148

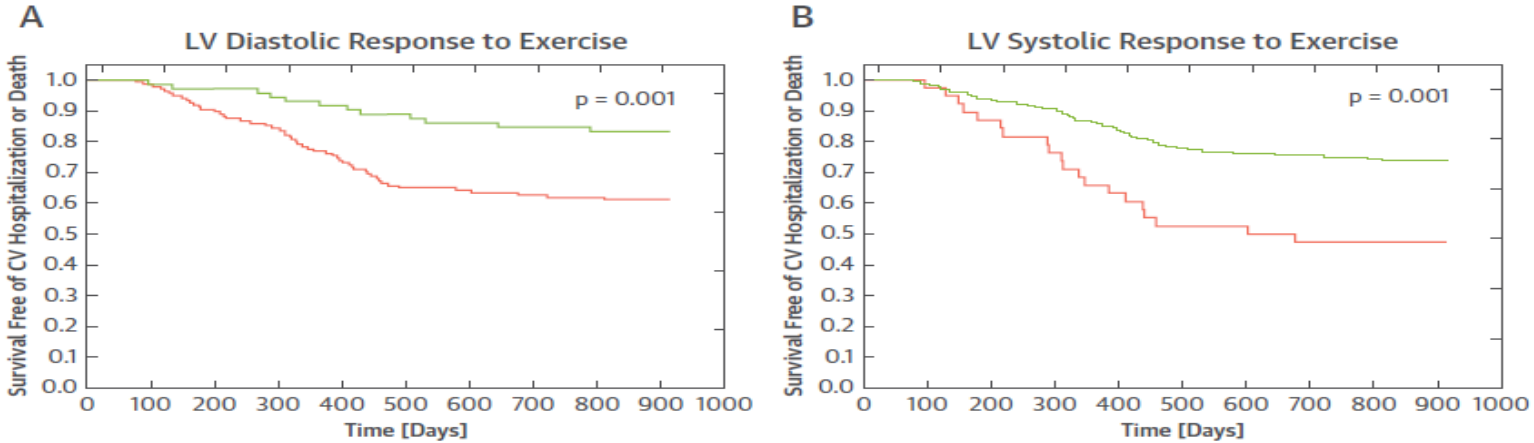
Houstis N. Circulation 2018;137:148-61

Prognostic value of exercise cardiac abnormalities in HFpEF

205 HFpEF echo rest and <u>after exercise</u>

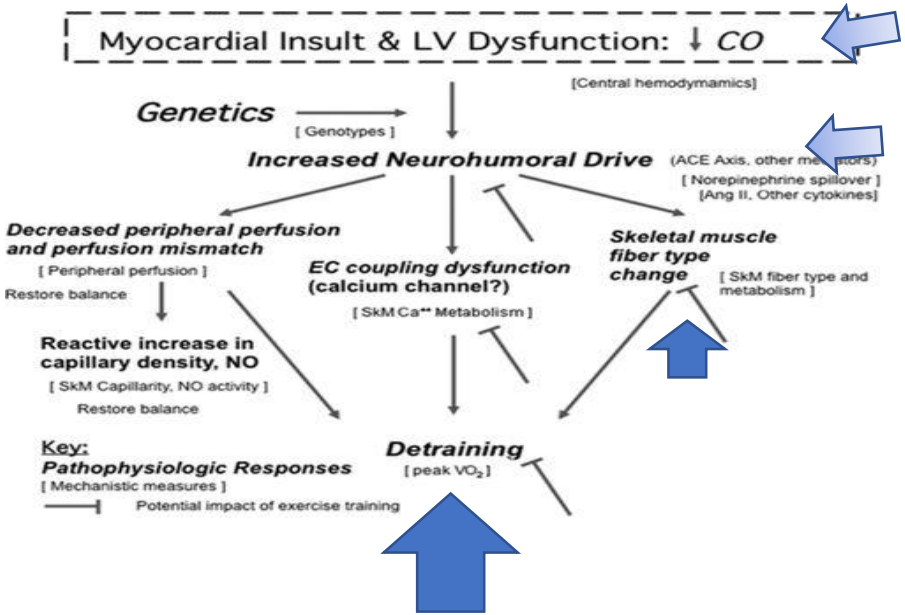
Abnormal diastolic response : E/e' > 14

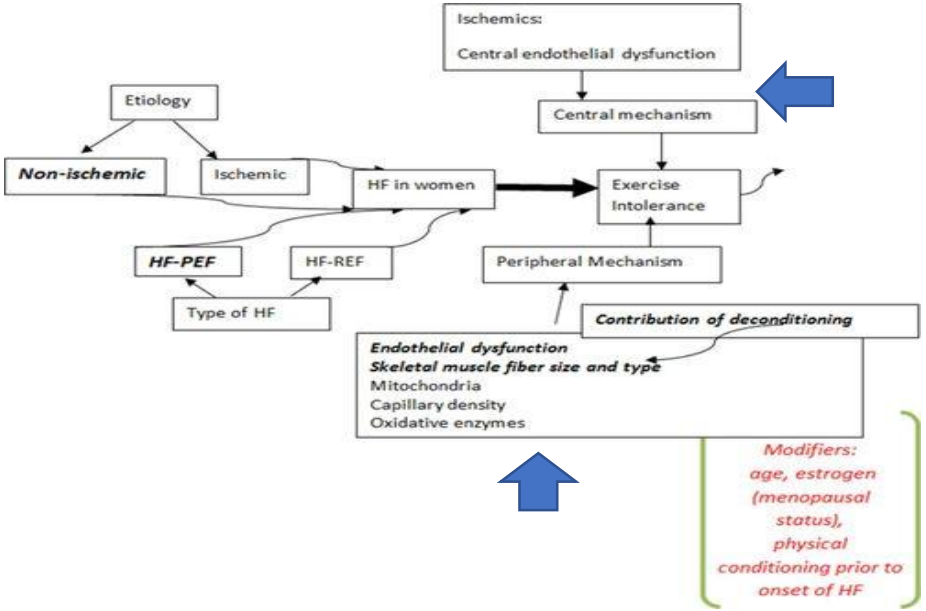
Abnormal systolic response : global peak systolic strain rate 0.8 s^{-1}



Kosmala W. Jam Coll Cardiol Imag 2018;11:1737-46

Possibles mécanismes d'amélioration par entraînement





Fleg J Circulation: Heart Failure. 2015;8:209–220

Cardiac Rehabilitation in HFpEF vs HFrEF

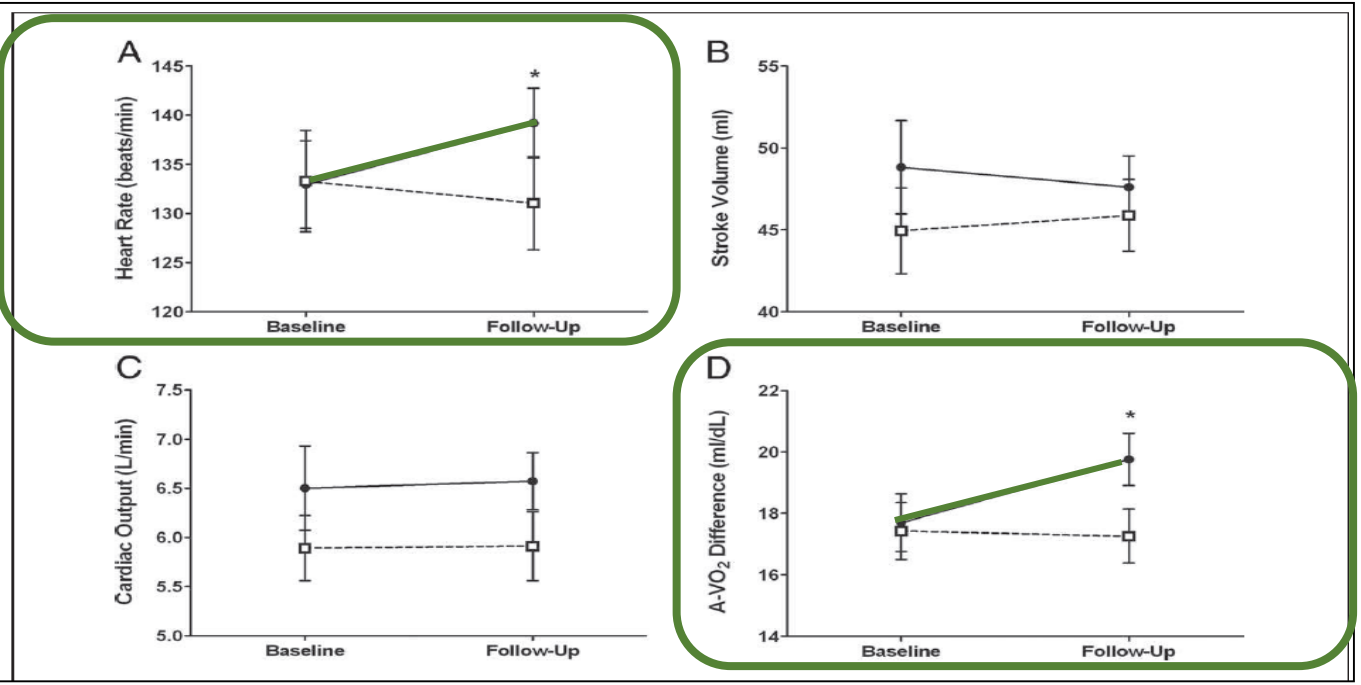
	HFrEF	HFpEF	HFrEF	HFpEF
	Rest		Exercise	
VO_2 peak			↑	↑
Cardiac Output	↔	↔	↑	↔
Stroke volume	↑ ↔	↔	↑	↔
HR	↓ ↔	↔	↔	↑ ↔
LVEDV	↓	↔	↔	↔
E/e’	↔	↔		
SVR	↓ ↔	↓ ↔	↓	↔
Endoth function	↑	↔		
AV O2 diff	↑	↔	↑	↑
Lean body mass	↔	↔		
% Fibers I, mitoch: capill	↑	↔		

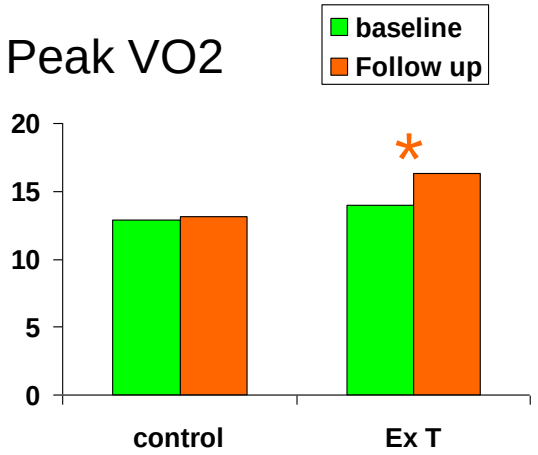
Tucker W. Heart Lung Circul 2018;27:9-21

study	Ex T	n	Age	% males	exercise	weeks	outcome
Angadi 2015	HIIT	9	69	89	4x4' 85-90% HR: 3' activ recovery 16 min, 3/week	4	VO2 EF, diastol fx, endothelial independ fx
	MCT	6	72	67	30 min,3/week, 60-70 % HR pic	4	
Edelmann 2011	ET	44 vs 20	64	45	Endur 50-70 % Vo2 20-40' 2-3/w+2/wRT 50-70 % 1-RM	12	VO2 EF, LV vol/ mass, diastol fx, QOL
Fu 2016	ET	30 vs 30	62	60	Cycle 30' 3/w 5x3'80 % VO2 3'40 % vo2	12	VO2, SV, CO, a-v diff, LV vol, diastol fxn, QOL
Kitzman 2010	ET	24 vs 22	70	17	Endur 60 min, 3/week, 40-70 % HRR	16	VO2 EF, LV vol/mass, sys/diastol fxn, QOL
Kitzman 2013	ET	24 vs 30	70	28	Endur 60 min, 3/week, 40-70 % HRR	16	VO2, SV, EF, LV vol, syst/diast fxn, endoth fxn, QOL
Haykowsky 2012	ET	22 vs18	68	20	Endur 60 min, 3/week, 40-70 % HRR	16	VO2, Peak EF, CO, SV, vol, SVR a-vO2diff
Smart 2012	ET	12 vs 13	67	58	Endur 60 min, 3/week, 60-70 % HRR	16	VO2, peak EF, CO,SV diast fxn, QOL

Endurance in HPpEF > 70 years

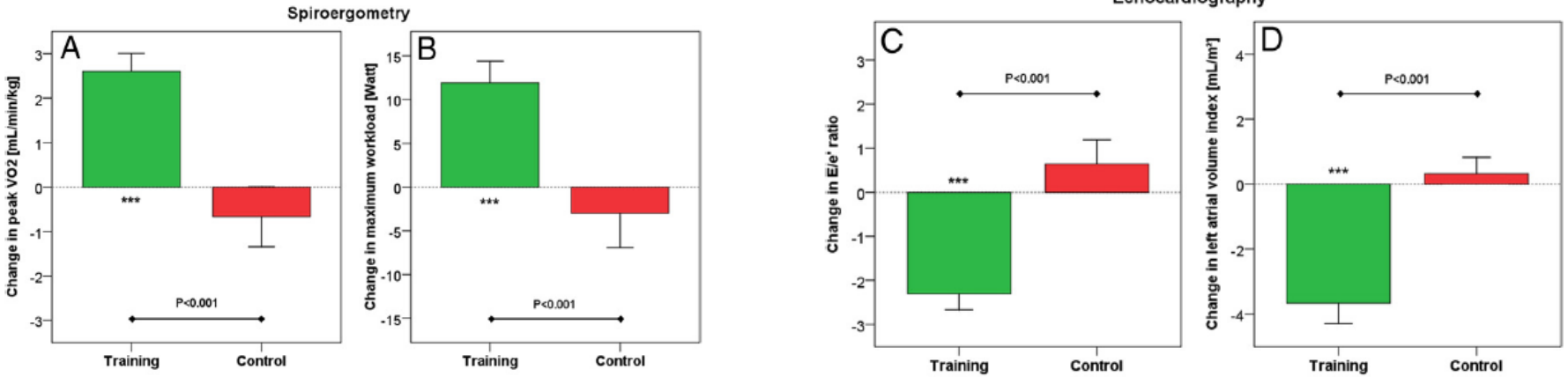
40 patients, training : 4 months, 3 sessions/week, 40-70 % HR reserve





Haykowsky M. J Am Coll Cardiol 2012;60:120

Ex-DHF pilot

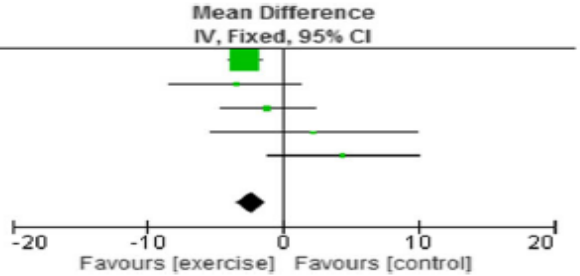


Edelmann F. J Am Coll Cardiol 2011;58:1780–91

E/e'

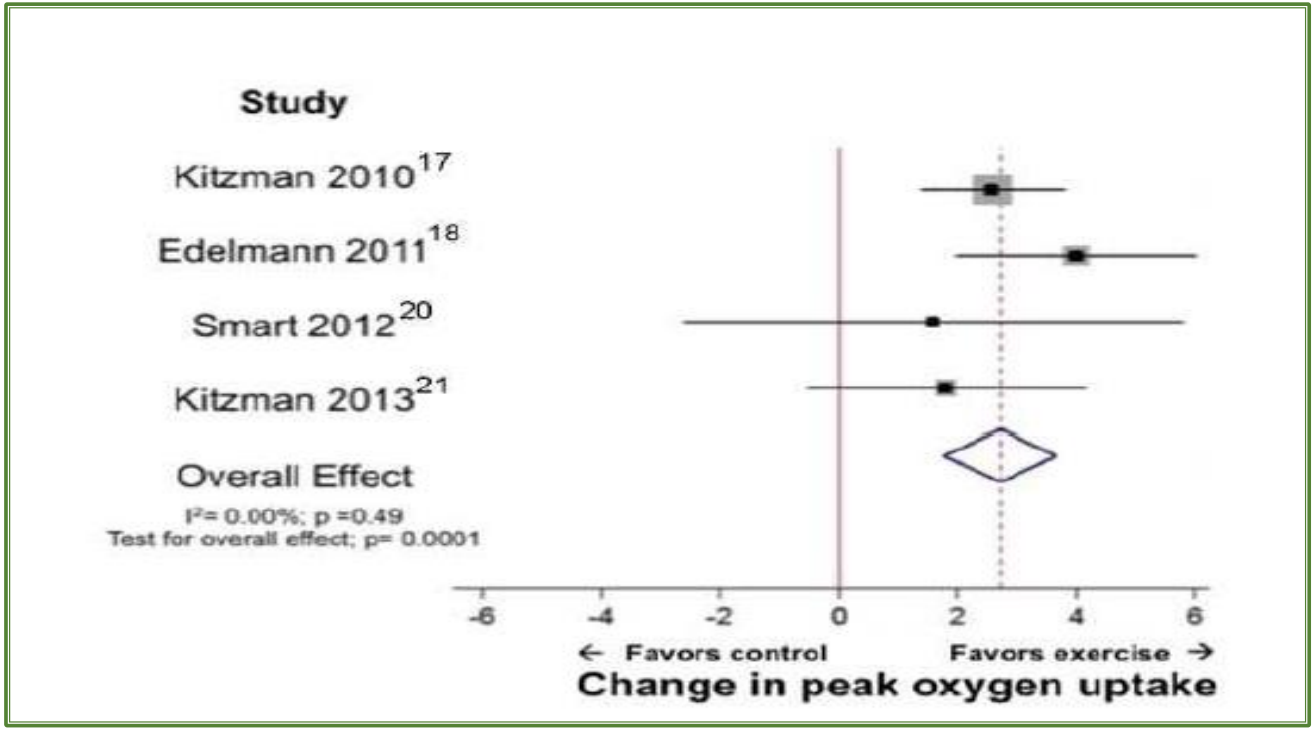
Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Edelmann 2011	-2.3	2.3024	44	0.6	2.3504	20	79.3%	-2.90 [-4.13, -1.67]
Fu 2016	-4.9	13.061	30	-1.4	3.6977	29	5.1%	-3.50 [-8.36, 1.36]
Karavidas 2013	-3.25	5.898	15	-2.06	3.7384	15	9.7%	-1.19 [-4.72, 2.34]
Palau 2014	-3.3	9.4503	14	-5.5	10.2501	12	2.1%	2.20 [-5.42, 9.82]
Smart 2012	4.4	9.8491	12	0.001	0.0017	13	3.9%	4.40 [-1.17, 9.97]
Total (95% CI)			115			89	100.0%	-2.38 [-3.47, -1.28]

Heterogeneity: Chi² = 8.39, df = 4 (P = 0.08); I² = 52%
Test for overall effect: Z = 4.24 (P < 0.0001)

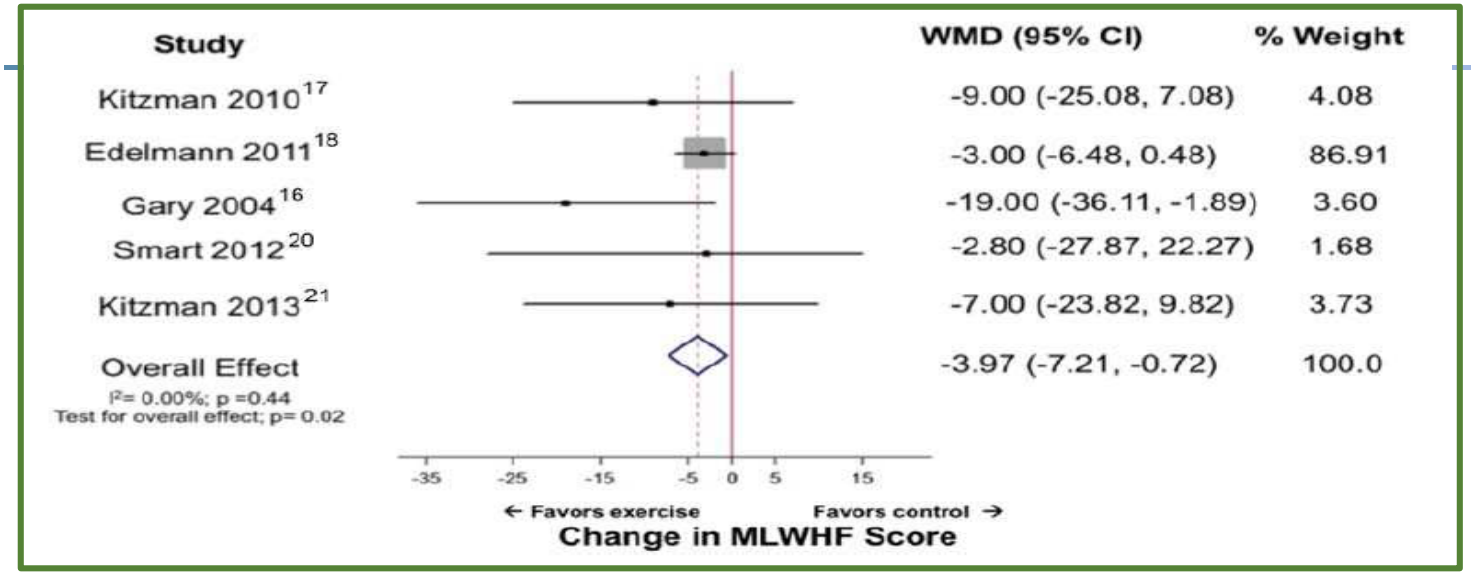


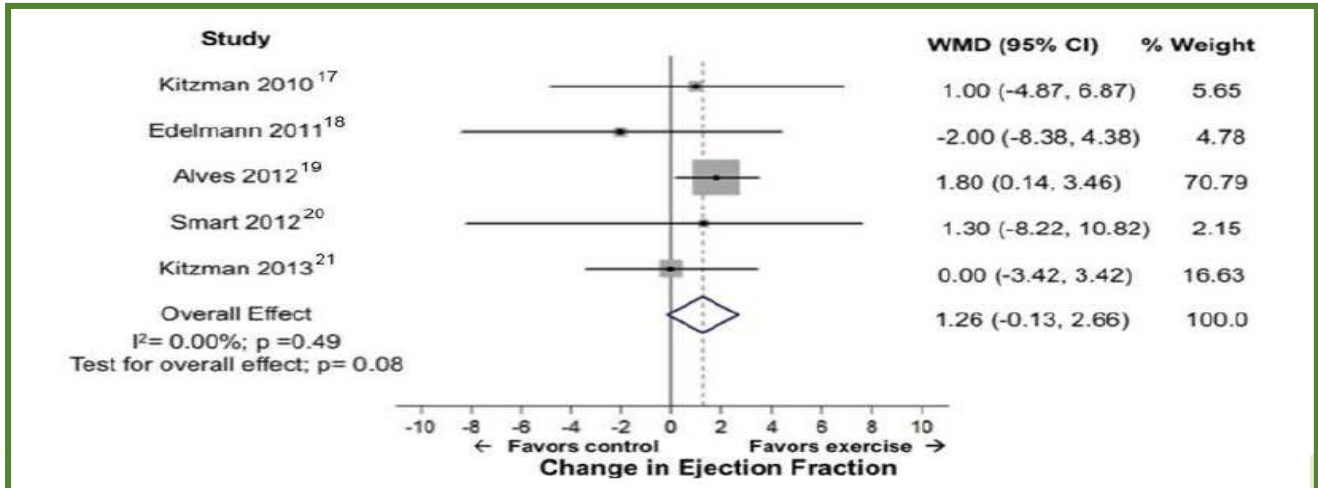
Heart Fail Rev (2017) 22:229–242

HFpEF

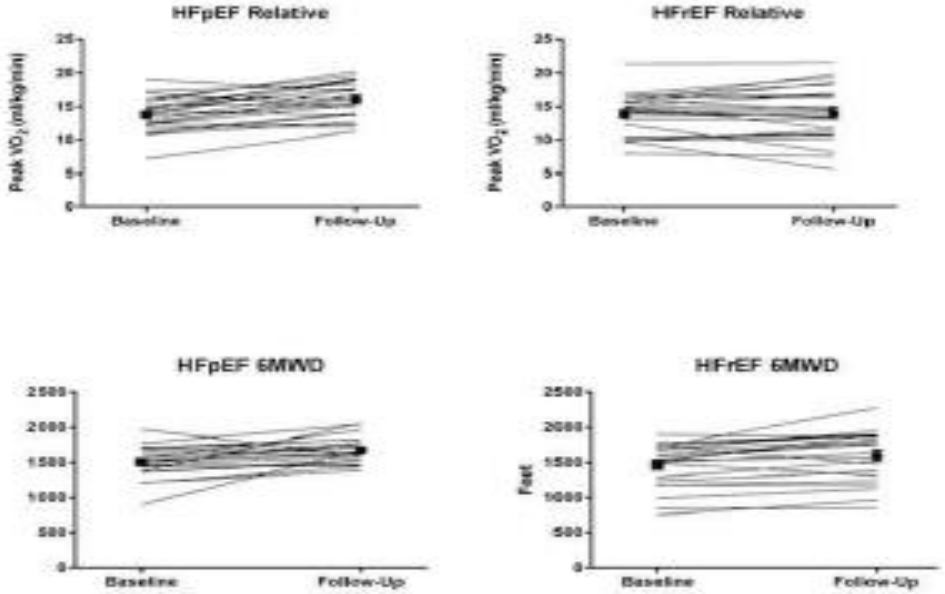


Circ Heart Fail. 2015;8:33-40.


Study
WMD (95% CI)
% Weight
Kitzman 2010 17
-9.00 (-25.08, 7.08)
4.08
Edelmann 2011 18
-3.00 (-6.48, 0.48)
86.91
Gary 2004 16
-19.00 (-36.11, -1.89)
3.60
Smart 2012 20
-2.80 (-27.87, 22.27)
1.68
Kitzman 2013 21
-7.00 (-23.82, 9.82)
3.73
Overall Effect
-3.97 (-7.21, -0.72)
100.0
I²= 0.00%; p =0.44
Test for overall effect; p= 0.02
-35 -25 -15 -5 0 5 15
← Favors exercise
Favors control →
Change in MLWHF Score

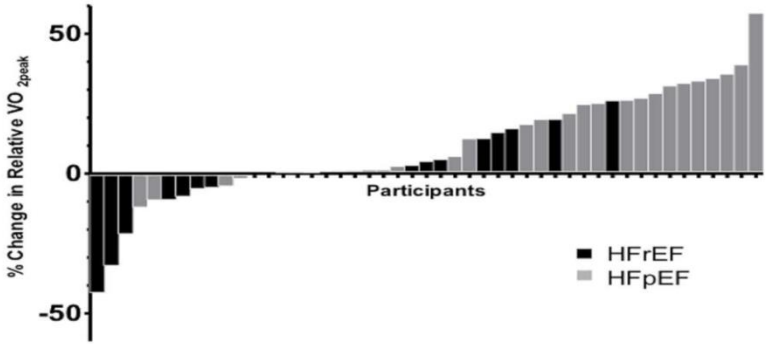

Study
WMD (95% CI)
% Weight
Kitzman 2010 17
1.00 (-4.87, 6.87)
5.65
Edelmann 2011 18
-2.00 (-8.38, 4.38)
4.78
Alves 2012 19
1.80 (0.14, 3.46)
70.79
Smart 2012 20
1.30 (-8.22, 10.82)
2.15
Kitzman 2013 21
0.00 (-3.42, 3.42)
16.63
Overall Effect
1.26 (-0.13, 2.66)
100.0
I²= 0.00%; p =0.49
Test for overall effect; p= 0.08
-10 -8 -6 -4 -2 0 2 4 6 8 10
← Favors control
Favors exercise →
Change in Ejection Fraction

Mêmes résultats pour ICFER ou ICFEP?
Pic VO2



48 HF patients (24 HFrEF and 24 HFpEF)

1heure entraînement (40-> 70 % réserve FC
3 /semaine
4 mois

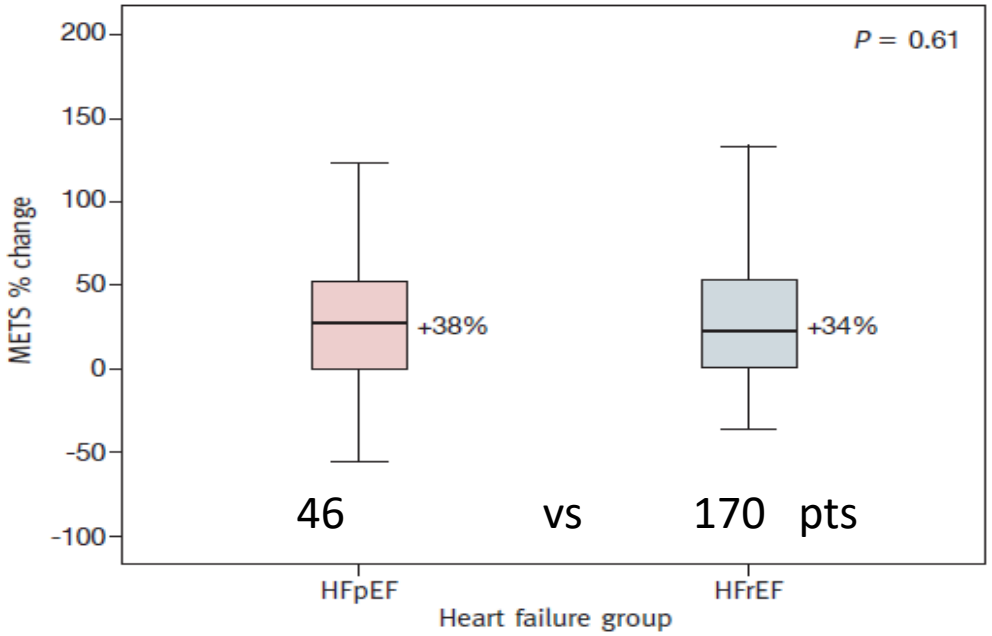


Pandey . *J Am Geriatr Soc.* 2017 August ; 65(8): 1698–1704.

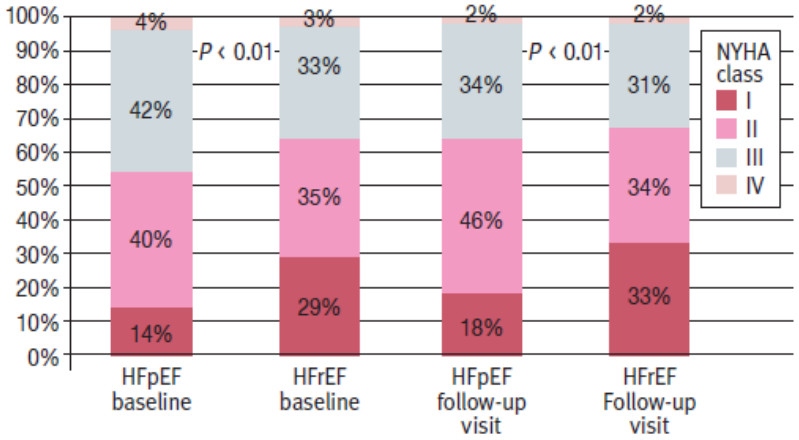
Ex training endurance 6 months

↑ METs = ↑ QOL

Percent change in functional capacity of both HFpEF and HFrEF patients after participation in an exercise training program



Changes in NYHA class from baseline to follow up evaluation

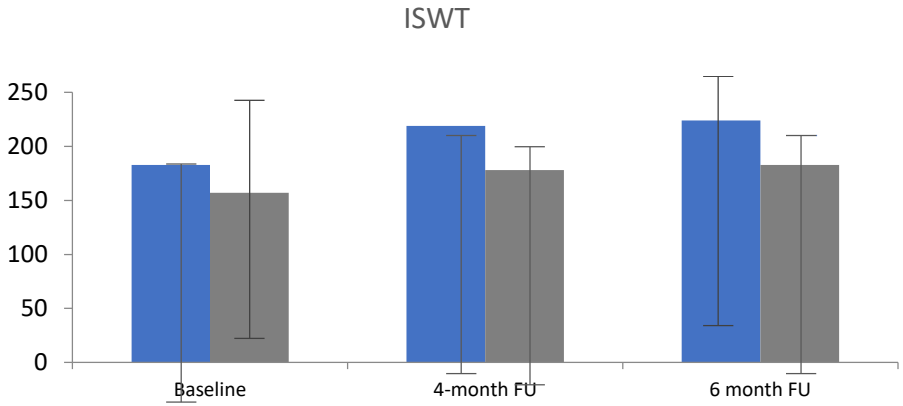


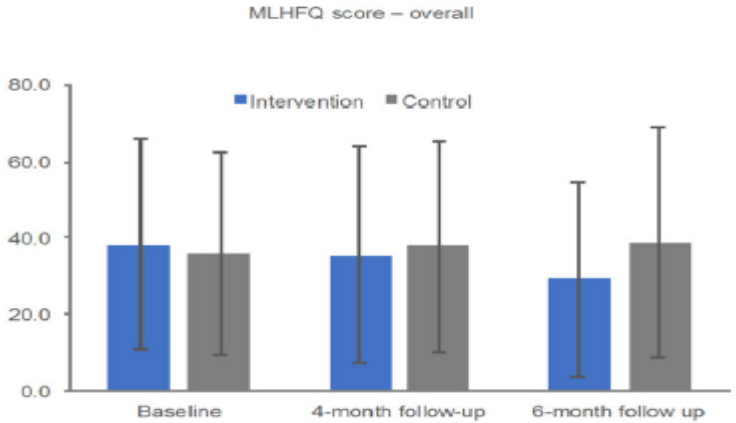
Klempfner R. IMAJ 2018; 20: 358–362

Pilot : Home based

50 pts (75 years, class II-III, 1-2 comorbidities)

Home based vs usual care





Lang C. BMJ Open 2018;8:e019649

REHAB-HF

349 patients post décompensation

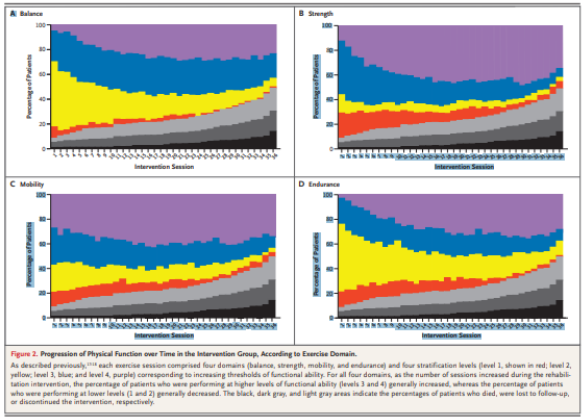


Figure 2. Progression of Physical Function over Time in the Intervention Group, According to Exercise Domain.

As described previously,[13,14] each exercise session comprised four domains (balance, strength, mobility, and endurance) and four stratification levels (level 1, shown in red; level 2, yellow; level 3, blue; and level 4, purple) corresponding to increasing thresholds of functional ability. For all four domains, as the number of sessions increased during the rehabilitation intervention, the percentage of patients who were performing at higher levels of functional ability (levels 3 and 4) generally increased, whereas the percentage of patients who were performing at lower levels (1 and 2) generally decreased. The black, dark gray, and light gray areas indicate the percentages of patients who died, were lost to follow-up, or discontinued the intervention, respectively.

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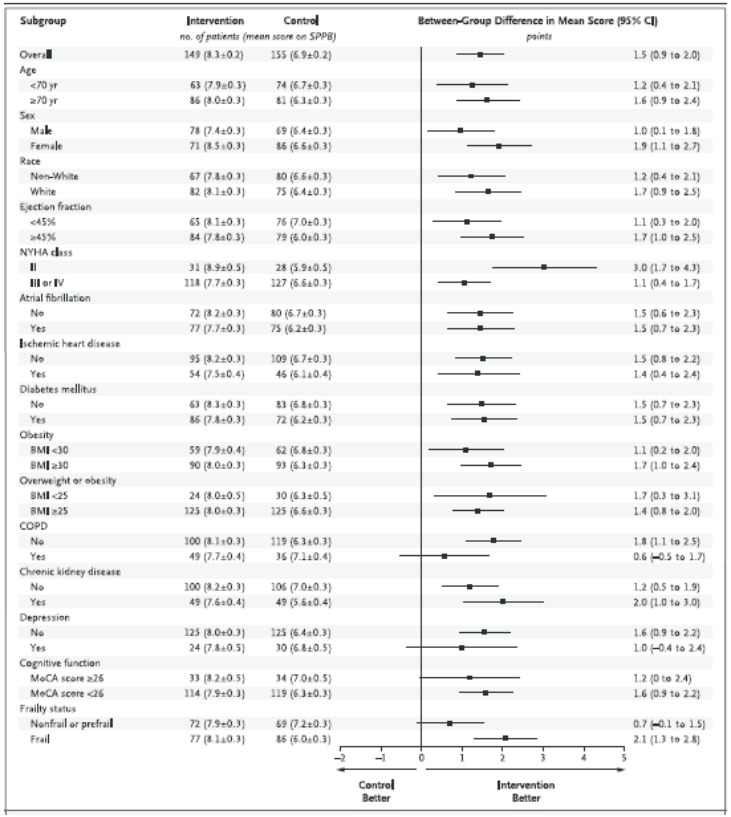
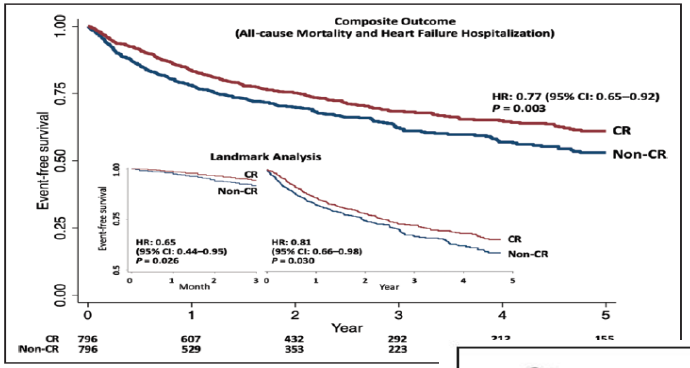
Outcome	Intervention (N=175)	Control (N=174)	Effect Size (95% CI)
Clinical events at 6 mo*			
No. of patients	174	173	
Rehospitalization for any cause, secondary outcome — no. of events (rate)	194 (1.18)	213 (1.28)	0.93 (0.66 to 1.19)‡‡
Death — no. of events (rate)	21 (0.13)	16 (0.10)	1.17 (0.61 to 2.27)‡‡
Combined rehospitalization for any cause and death — no. of events (rate)	215 (1.31)	229 (1.38)	0.93 (0.77 to 1.12)‡‡
Rehospitalization for heart failure — no. of events (rate)	94 (0.57)	110 (0.66)	0.89 (0.56 to 1.22)‡‡
No. of patients with ≥2 rehospitalizations for any cause (%)	47 (27)	60 (35)	0.71 (0.44 to 1.13)§§
No. of patients with ≥2 rehospitalizations for heart failure (%)	22 (13)	27 (16)	0.78 (0.41 to 1.46)§§
No. of days of rehospitalization for any cause	7.2	7.6	0.92 (0.52 to 1.22)‡‡
No. of patients with ≥1 fall (%)	48 (28)	62 (36)	0.67 (0.42 to 1.06)§§
No. of patients with ≥1 fall that resulted in injury (%)	12 (7)	16 (9)	0.66 (0.30 to 1.47)§§

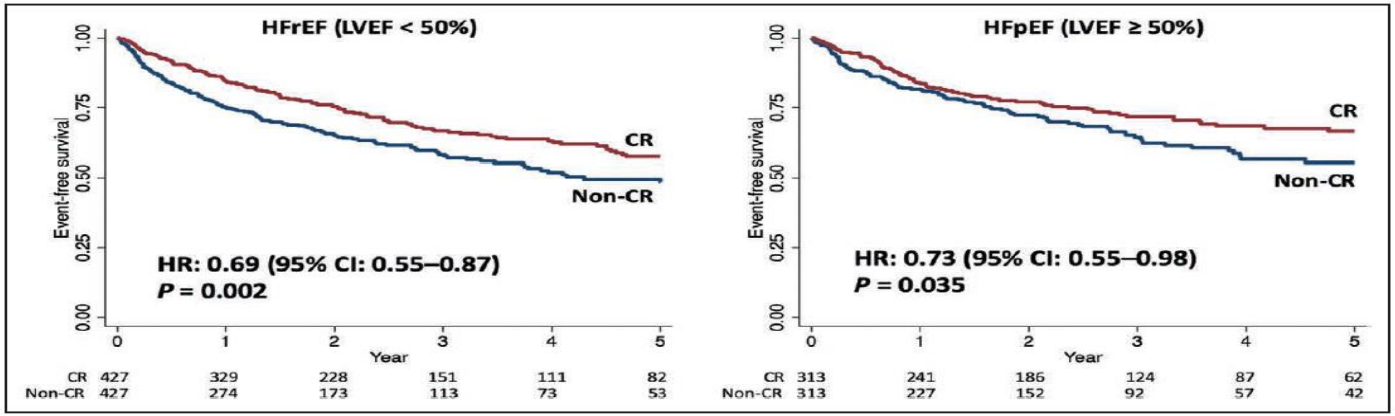


Kitzman D. N Engl J Med 2021; 345: 203-16

Mêmes résultats pour ICFER ou ICFEP? Pronostic



3277 pts (75 ± 15 ans) , 26 % en RC



Kamiya *Circ Heart Fail.* 2020;13:e006798.

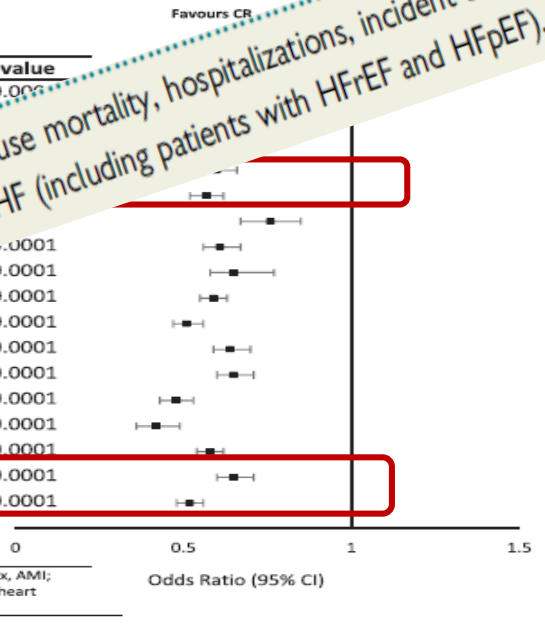
Etude rétrospective USA

20 82 IC en RC vs 20182 IC sans RC

Suivi 2 ans

Subgroup	Participants (n)	Odds Ratio	95% CI	*P*-value
Total cohort	40,364	0.58	0.54-0.62	<0.000
Female	14,772	0.61	0.54-0.67	
Male	25,391	0.57	0.53-0.	
Aged ≥75 years	15,419	0.6		
Aged <75 years	25,174	0.57		
BMI ≥30	12,370			
BMI <30	13,498			.0001
History of stroke				<0.0001
No history of stroke			-0.63	<0.0001
History of AMI			0.47-0.56	<0.0001
No history of		.64	0.59-0.7	<0.0001
Histor		0.65	0.6-0.71	<0.0001
		0.48	0.43-0.53	<0.0001
	7,404	0.42	0.36-0.49	<0.0001
	26,216	0.58	0.54-0.62	<0.0001
	18,485	0.65	0.6-0.71	<0.0001
	20,140	0.52	0.48-0.56	<0.0001

CR; cardiac rehabilitation, HF; heart failure, AF; atrial fibrillation, 95% CI; 95% confidence interval, BMI; body mass index, AMI; acute myocardial infarction, SBP; systolic blood pressure, HFpEF; heart failure with preserved ejection fraction, HFrEF; heart failure with reduced ejection fraction.

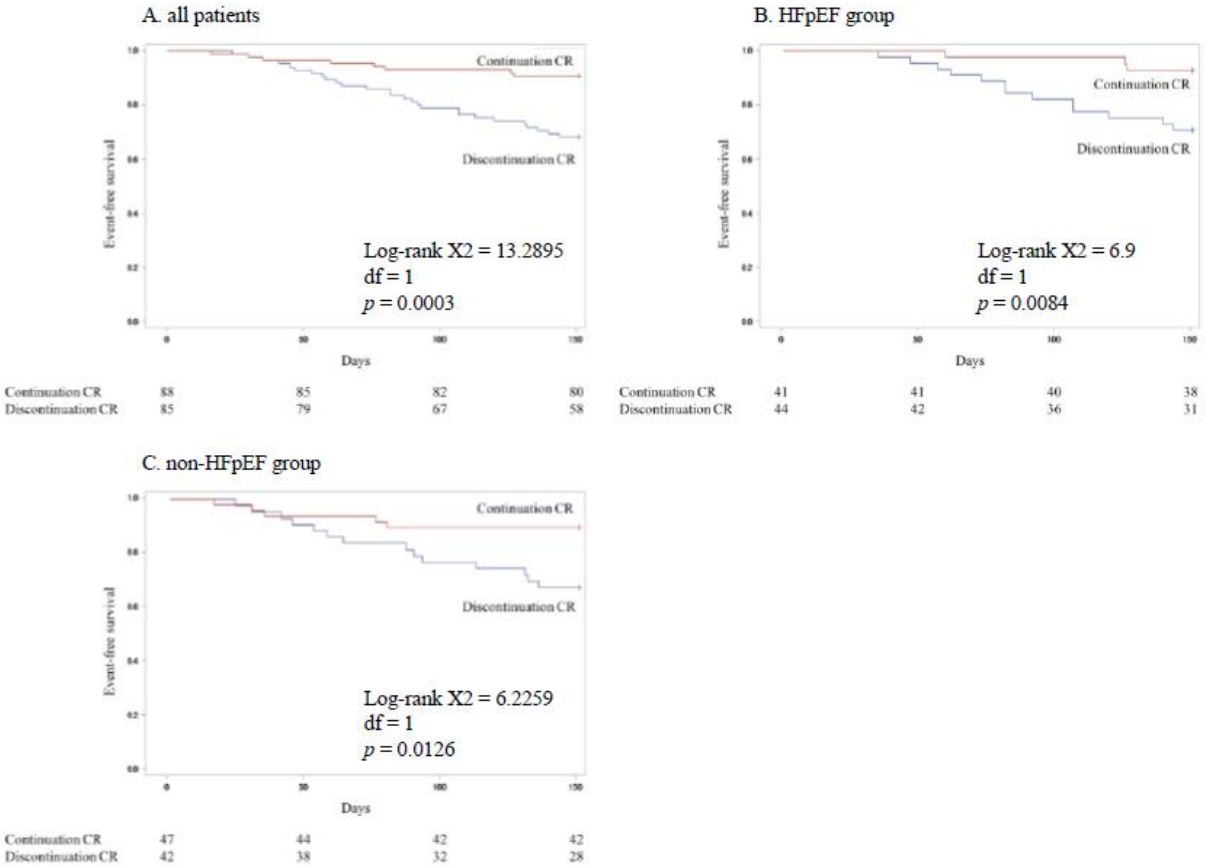


Conclusion

Exercise-based CR was associated with lower odds of all-cause mortality, hospitalizations, incident stroke, and incident atrial fibrillation at 2-year follow-up for patients with HF (including patients with HFrEF and HFpEF).

Buckley B. Eur J Prev Cardiol 2021;28:1704-1710

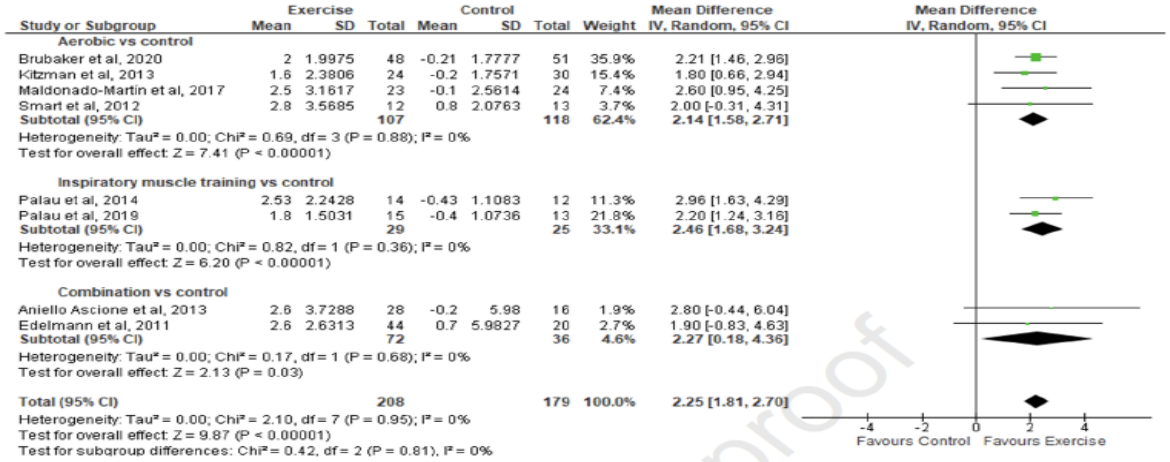
Difference in Prognosis between Continuation and Discontinuation of A 5-Month Cardiac Rehabilitation Program in Outpatients with Heart Failure with Preserved Ejection Fraction

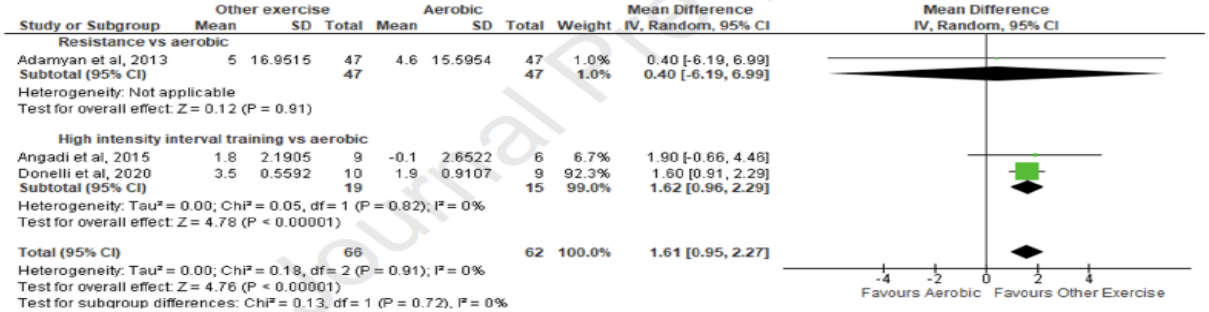


173 patients
RC de 5 mois

Morita H. J Clin Med 2021; 10 : 3306

Effects of different exercise programs on cardiorespiratory reserve in HFpEF: a systematic review and meta-analysis





Ex vs control

Aerobic

IMT

Aerobic + IMT

Autre vs Aerobic

Resistance

HIIT

Boulmpou A. Hellenic J Cardiol 2021

OptimEx-CLIN Study:
Optimizing Exercise Training in HFpEF

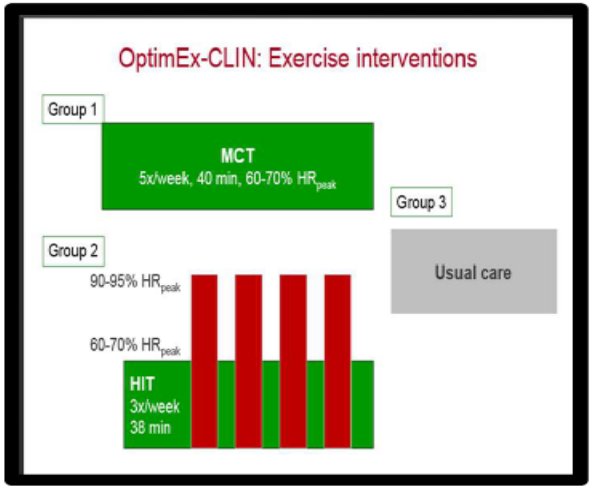
Multicenter, prospective, randomised, controlled trial

Study design:
- n= 180 (1:1:1-Randomisation)
- 12 months intervention (endurance Training)
- primary endpoint: peak VO_2

Principle Investigators:
M. Halle, Ch. Suchy; A Duvinage, S Wachner, Munich/Germany
V. Adams/A. Linke, Leipzig/Germany
U. Wisloff, O. Rognmo, Trondheim/Norway
F. Edelmann, B. Pieske, Berlin/Germany
E. van Craenenbroeck, P. Beckers, C Vrints, Antwerp/Belgium

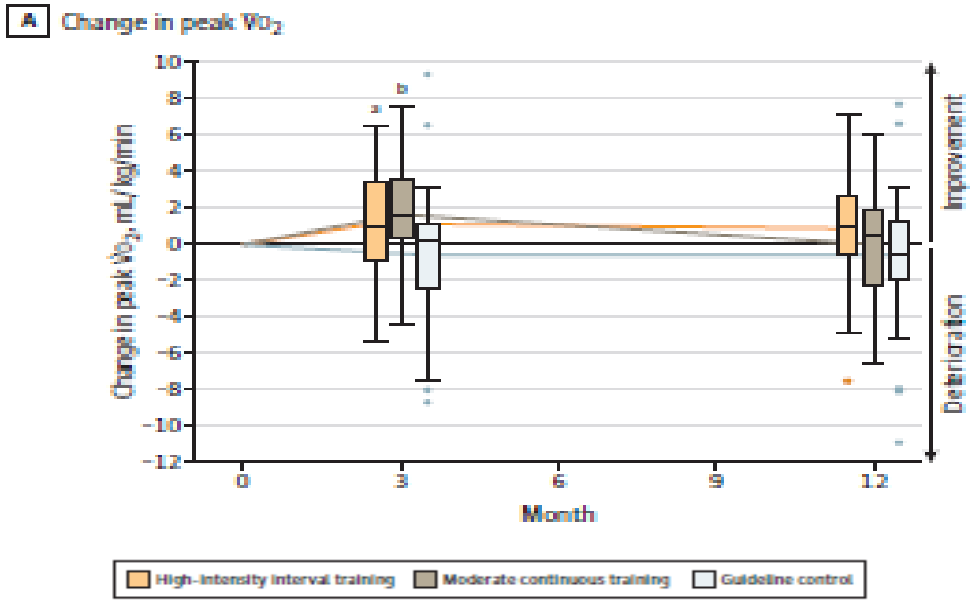
SEVENTH FRAMEWORK PROGRAMME

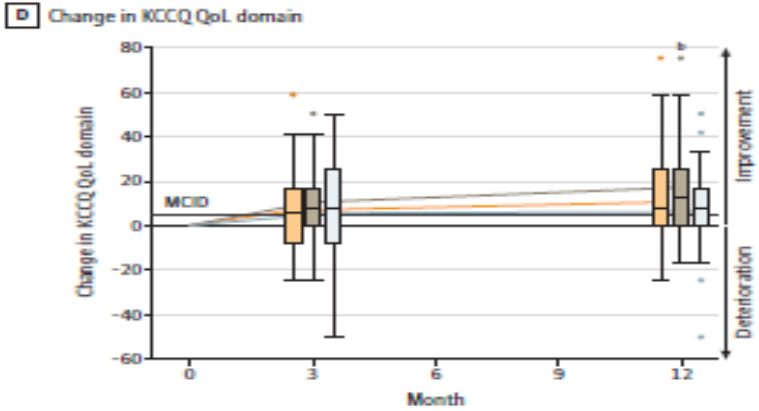
180 patients



180 pts OPTIMEX

INTERVENTIONS Patients were randomly assigned (1:1:1; n = 60 per group) to high-intensity interval training (3 × 38 minutes/week), moderate continuous training (5 × 40 minutes/week), or guideline control (1-time advice on physical activity according to guidelines) for 12 months (3 months in clinic followed by 9 months telemedically supervised home-based exercise).





JAMA. 2021;325(6):542-551.

CR : non seulement exercice

Traditional CR Model for HF

Site-based

Moderate intensity aerobic exercise

Exercise prescription based on VO_2 testing

Strict inclusion criteria:
- EF ≤ 35%
- No hospitalization within 6 weeks
- No procedures within 6 months

Novel CR Model for Older Adults with HF

Implement Now:

Hybrid or home-based models for patients meeting traditional inclusion criteria

Routine screening:
- Frailty
- Multimorbidity
- Polypharmacy
- Cognitive impairment
- Depression
- Poor social support

Multi-domain exercises
- Guided by SPPB or other physical performance assessments
- Strength
- Balance
- Mobility (e.g. start/stop, turns, pace)
- Endurance (e.g. walking)

Requires further study:

In patients recently hospitalized and/or with HFpEF:
- Hybrid or Home-based CR
- Multi-domain exercise prescription based on multi-domain physical function

In all older adults with HF:
- Novel methods for seamlessly incorporation lifestyle and geriatric-specific interventions into CR

Flint K Clin Geriatr Med 2019;35:517-26

Conclusions

L'IC FE préservée reste un challenge pour les cardiologues

La Réadaptation Cardiaque améliore les capacités d'effort et la QOL et probablement le pronostic

Les programmes doivent être adaptés au phénotype de chaque patient