



FORUM EUROPÉEN, CŒUR, EXERCICE & PRÉVENTION

Particularités d'un programme de revalidation cardiaque chez la femme

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Je déclare n'avoir aucun conflit d'intérêt



La réadaptation...

- ❑ Maladies CV 1^{ère} cause de mortalité chez ♀
- ❑ >80.000 1^{er} infarctus en France chaque année chez ♀
 - ❑ Survivantes: ↑ risque nouveau syndrome coronarien, arrêt CV, mais aussi sédentarité/incapacité physique,...
 - ❑ CPI: bénéfiques réadaptation ♀ et ♂
- ❑ Réadaptation cardiaque conseillée
 - Facteurs de risque
 - Qualité de vie
 - Mortalité/survie (♀: ↑1 ml/min/kg VO₂max ↓ 10% mortalité cardiaque)
 - Risque d'hospitalisation

•

Exercise is recommended for all patients who are able in order to improve exercise capacity, QOL, and reduce HF hospitalization. c 324–328,335–337

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Lavie et al Mayo Clin Proc 2015
McDonagh, ESC 2021



Réadaptation cardiaque est ...

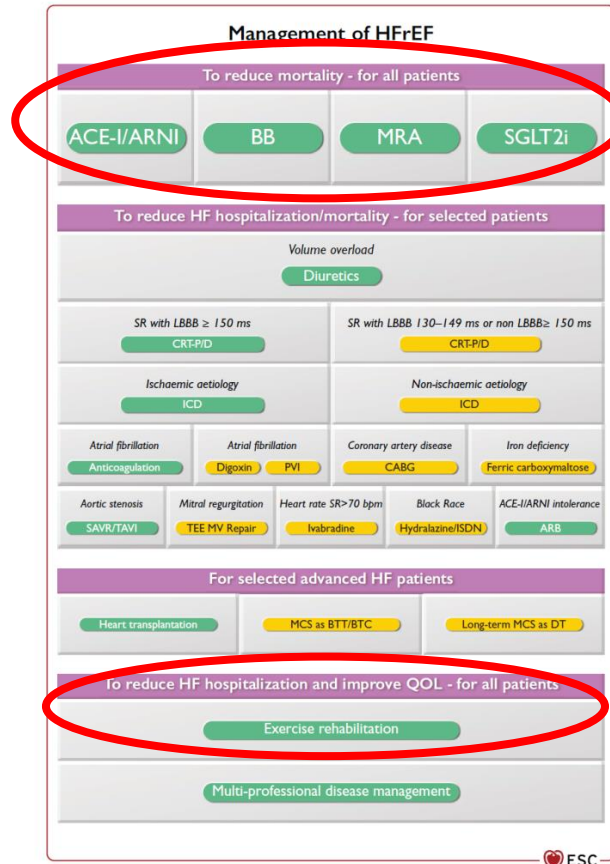
- ❑ Recommandée
- ❑ Mais sous utilisée
- ❑ 267.427 candidats après infarctus ou CABG aux USA
 - 13.9% après infarctus et 31% après CABG arrivent en revalidation
 - 14.3% chez les femmes en moyenne

Characteristic	No. of Patients	Percentage of Cohort	Crude Rate of Any CR Use, %
Gender and age group			
Men (overall)	149 383	55.9	22.1
65–74 y	84 089	31.4	26.6
75–84 y	54 012	20.2	18.6
≥85 y	11 282	4.2	4.6
Women (overall)	118 044	44.1	14.3
65–74 y	47 908	17.9	21.7
75–84 y	49 122	18.4	12.4
≥85 y	21 014	7.9	2.1

Suaya Circulation 2007



IDEM Avec le reste?



Non-Inclusion RC

- ❑ L'orientation **des** prestataires de soins vers RC
 - ♂ et ♀: Information et connaissance de l'existence et des bienfaits de la RC
 - ♀: Perception du soutien des prestataires pour la RC

- ❑ Barriere socio-économique
 - Revenus annuel (et travail)
 - Éducation scolaire (langage,...)
 - Minorité sociale

- ❑ Accessibilité
 - Transport (♀ plus âgées, permis,..)

- ❑ IDENTIFIER LES BARRIERES A LA PARTICIPATION RC

Yoo 2019, Thomas 1996, Allen 2004, Sawan 2022



Effect of Cardiac Rehabilitation Referral Strategies on Utilization Rates

A Prospective, Controlled Study

Sherry L. Grace, PhD; Kelly L. Russell, MSc; Robert D. Reid, PhD, MBA; Paul Oh, MD, FRCPC; Sonia Anand, MD, PhD, FRCPC; James Rush, PhD; Karen Williamson, PhD; Milan Gupta, MD; David A. Alter, MD, PhD, FRCPC; Donna E. Stewart, MD, FRCPC; for the Cardiac Rehabilitation Care Continuity Through Automatic Referral Evaluation (CRCARE) Investigators

Arch Intern Med, 2011

- Habituelle (? Rien?)
- VS
- Discussion patient avec professionnels
- Enregistrement automatique comme consultation cardio
- Les deux

⇒ prise en charge précoce, explication et rdv « automatique »

≠ de OR entre référés et inscrits

Table 4. GEE Analysis of Cardiac Rehabilitation (CR) Referral and Enrollment Rates by Referral Strategy^a

Variable	OR (95% CI)	
	Unadjusted	Adjusted
CR referral		
Liaison only	3.06 (2.26-4.16)	3.35 (1.54-7.29)
Automatic only	5.05 (3.71-6.87)	3.27 (1.52-7.04)
Combined automatic and liaison	12.64 (8.83-18.08)	8.41 (3.57-19.85)
Usual	1 [Reference]	1 [Reference]
CR enrollment		
Liaison only	2.49 (1.82-3.41)	2.60 (1.20-5.62)
Automatic only	3.57 (2.62-4.87)	2.35 (1.10-4.99)
Combined automatic and liaison	6.40 (4.60-8.88)	4.45 (1.98-10.00)
Usual	1 [Reference]	1 [Reference]

Abbreviations: CI, confidence interval; GEE, generalized estimating equation; OR, odds ratio.

^aControlled for age, sex, ethnicity, income, index cardiac event/condition, presence of diabetes mellitus, body mass index, functional capacity, family history of cardiovascular disease, and the presence of hypertension.

Inclusion ≠ participation ≠ participation complète!



CARDIAC REHABILITATION IS UNDERUSED

**Cardiac Rehabilitation Enrollment, Engagement, and Completion
Among Medicare Beneficiaries Aged 65 and Over**
who had a primary qualifying event* in 2017:



Enrollment rates by sex:



Enrollment rates by race/ethnicity:



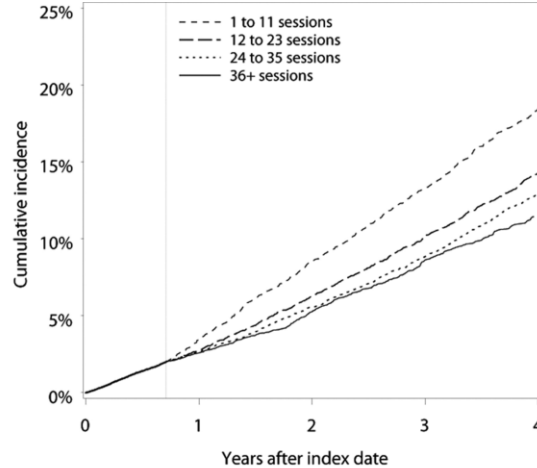
* hospitalization for acute myocardial infarction; coronary artery bypass graft surgery; heart valve repair or replacement; percutaneous coronary intervention; or heart or heart-lung transplant.

Keteyian SJ, Jackson SL, Chang A, et al. Tracking Cardiac Rehabilitation Utilization in Medicare Beneficiaries: 2017 Update. *J Cardiopulm Rehabil Prev.* 2022;42(4):235-245.



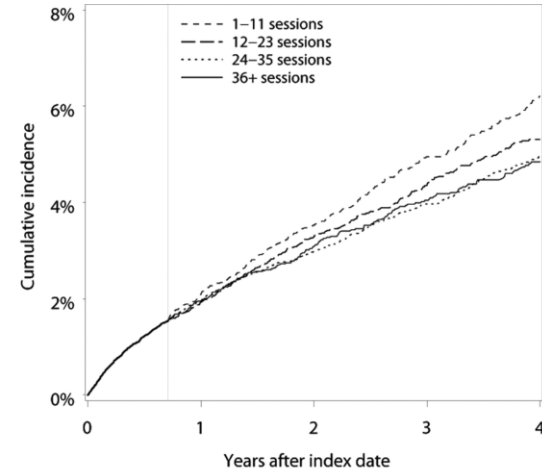
Dose réponse et drop out

□ Importance de la **dose – réponse** (récidive,..) et impact du **drop out**



No. at risk	Years after index date			
Overall	30,161			
1 to 11 sessions	5937	4883	3865	2859
12 to 23 sessions	6933	5716	4427	3223
24 to 35 sessions	10,978	8955	6905	4885
36 sessions	5465	4513	3523	2481

Mortalité à 4 ans



No. at risk	Years after index date			
Overall	30,161			
1 to 11 sessions	5693	4573	3572	2582
12 to 23 sessions	6695	5406	4113	2943
24 to 35 sessions	10,708	8546	6516	4514
36 sessions	5314	4286	3297	2271

Récidive Infarctus à 4 ans

Drop out

- ❑ Taux de drop out élevé dans la littérature (>20-30%)
- ❑ Taux de drop out ♀ > ♂
 - Responsabilité familiale
 - Garde du conjoint et/ou enfants
 - + de comorbidités
 - Perception de l'effort (+douloureux)
 - Santé mentale
 - Accessibilité et diversité des programmes de RC
 - Flexibilité des programmes et séances
 - Programme par organisation communautaire
- ❑ Profil drop out femmes: Agées, > FRCV, > dépression et anxiété (Backie 2015)

Drop out

Drop Out : Femme: 35% (n=1081); Homme 29% (n=4833)

Table 4 Baseline factors associated with premature withdrawal from cardiac rehabilitation

Predictor variable	Wald χ^2 test	Odds ratio	95% confidence interval	P value
→ VO _{2peak}	90.34	0.932	0.919–0.946	<0.001
Age (years)	78.42	0.972	0.966–0.978	<0.001
Smoking	35.73	2.307	1.754–3.035	<0.001
CABG	20.04	0.754	0.667–0.853	<0.001
Not married	19.84	1.385	1.200–1.559	<0.001
Obesity (≥ 30 kg/m ²)	15.23	1.296	1.138–1.476	<0.001
No β -blocker medications	8.17	1.220	1.064–1.398	0.004
Diabetes	7.16	1.214	1.053–1.400	0.007
No lipid lowering agent	5.31	1.184	1.026–1.366	0.021
Antidepressant medications	4.14	1.299	1.010–1.672	0.042
Sex, female	1.935	0.890	0.756–1.049	0.164

CABG, coronary artery bypass graft surgery; VO_{2peak}, peak oxygen uptake.

Identifier les personnes à risque de Drop Out

Marzolini, JPrevCard, 2008



Composantes essentielles de la revalidation cardiaque

- ❑ Prise en charge individuelle pour optimisation de la RC
 - Prescription individuelle des programmes (RC ≠ recette)
 - Testing (Ergospirométrie/EFX)
 - Perception effort, réassurance, explication au patient
 - Intérêt de la mesure de la VO_2 max avec examen médical

Table 4
Gender differences in diagnostic and therapeutic procedures during cardiac rehabilitation.

	Females (n = 604)	Males (n = 1677)	p value
6-minute walking test on admission	273 (45.3%)	710 (42.3%)	0.202
6-minute walking test at discharge	272 (45.1%)	675 (40.3%)	0.033
Exercise test on admission	82 (13.6%)	364 (21.7%)	<0.0001
Exercise test at discharge	126 (20.9%)	579 (34.5%)	<0.0001
Cardiopulmonary exercise test on admission	15 (2.5%)	107 (6.4%)	0.0003
Cardiopulmonary exercise test at discharge	19 (3.2%)	138 (8.2%)	<0.0001
Echocardiography	548 (91%)	1538 (91.7%)	0.60
Number of echocardiography exams	1.17 ± 0.7	1.14 ± 0.7	0.367
Left ventricular ejection fraction >50%	379 (63.2%)	960 (57.3%)	0.012
Left ventricular ejection fraction 30–49%	142 (23.8%)	470 (28.1%)	0.041
Left ventricular ejection fraction <30%	29 (0.05%)	108 (0.07%)	0.870
Holter ECG monitoring	256 (42.5%)	664 (39.6%)	0.213
Ambulatory blood pressure monitoring	21 (3.5%)	105 (6.3%)	0.01
Telemetry monitoring >72 hours	194 (32.2%)	500 (29.8%)	0.272
Geriatric multidimensional evaluation	142 (23.5%)	312 (18.6%)	0.01
Parenteral nutrition	0	3 (0.2%)	0.272

Pourquoi?!?

Tester (tous) les patients

Début du programme de RC

❑ Recommandation: aérobie + renforcement musculaire

- Peu d'études mesurent l'intérêt des 2 chez les femmes vs hommes

❑ Femmes ont généralement une VO_2 max plus faible à l'arrivée (indépendant du type de pathologies) (Rengo 2020, Savage 2009, Gaalemema 2019)

Table 1		Table 2			
Clinical Data and Demographics at		Baseline Aerobic Capacity (mL·kg ⁻¹ ·min ⁻¹) by Index Diagnosis ^a			
	Index Diagnosis	Total	Women	Men	Men (n = 2985)
Age, yr	PCI	20.8 ± 7.3 (898)	15.8 ± 4.6 (219)	22.4 ± 7.3 ^b (679)	62 ± 11 ^b
Weight, kg	MI	20.4 ± 7.3 (1219)	15.8 ± 5.0 (320)	22.0 ± 7.3 ^b (899)	90 ± 18 ^b
Body mass index, kg·m ⁻²	CA	19.6 ± 7.1 (109)	16.8 ± 7.4 (35)	21.0 ± 6.5 ^c (74)	29.4 ± 5.2
Waist circumference, cm	CABG	17.4 ± 5.0 (1249)	13.9 ± 3.5 (222)	18.2 ± 5.0 ^b (1027)	104.1 ± 13.2 ^b
$\dot{V}O_{2peak}$, mL·kg ⁻¹ ·min ⁻¹	HVS	17.4 ± 5.7 (189)	15.1 ± 5.1 (67)	18.7 ± 5.6 ^b (122)	20.4 ± 6.7 ^b
RER	Stable angina	17.4 ± 5.5 (78)	15.3 ± 3.7 (24)	18.4 ± 5.9 ^d (54)	17.8 ± 5.7 ^b (101)
Handgrip strength, kg	CHF	16.6 ± 5.5 (138)	13.6 ± 3.6 (37)	17.8 ± 5.7 ^b (101)	17.8 ± 5.7 ^b (101)
MOS SF-36 Physical Function	TAVR	14.2 ± 4.3 (12)	12.7 ± 3.2 (5)	15.2 ± 4.9 (7)	1.12 ± 0.11 ^b
Days to CR entry					41 ± 10 ^b
					66 ± 25 ^b
					38 ± 26 ^b

Abbreviations: CA, cardiac arrhythmia; CABG, coronary artery bypass graft; CHF, chronic heart failure; HVS, heart valve surgery; MI, myocardial infarction; PCI, percutaneous intervention; TAVR, transcatheter aortic valve replacement.

^aData are presented as mean ± SD (n). There was a significant interaction between baseline aerobic capacity and diagnosis ($P < .001$). *Post hoc* comparisons with LSD: PCI vs CABG,^b CHF,^b stable angina,^b HVS,^b TAVR^b; MI vs CABG,^b CHF,^b stable angina,^b HVS,^b TAVR^b; CA vs CABG,^b CHF,^b HVS,^c TAVR,^c stable angina.^d

^bBetween-group $P < .001$.

^cBetween-group $P < .01$.

^dBetween-group $P < .05$.

Gain lors de la RC

❑ HIIT

❑ 27 ± 10 sessions (idem ♂♀)

Table 3
Improvement in Aerobic Capacity (mL·kg⁻¹·min⁻¹) by Index Diagnosis^a

Index Diagnosis	Total	Women	Men
HVS	4.5 ± 3.4 (+26%) (110)	3.5 ± 2.2 (+23%) (38)	5.0 ± 3.8 (+27%) (72)
CABG	4.0 ± 3.8 (+23%) (597)	2.3 ± 2.5 (+16%) (99)	4.4 ± 4.0 (+25%) (498)
CHF	3.3 ± 3.4 (+20%) (34)	2.3 ± 2.4 (+16%) (11)	3.7 ± 3.8 (+22%) (23)
MI	2.8 ± 3.4 (+14%) (568)	1.8 ± 2.6 (+11%) (139)	3.2 ± 3.5 (+14%) (429)
PCI	2.4 ± 3.6 (+12%) (415)	1.3 ± 2.9 (+8%) (99)	2.7 ± 3.7 (+12%) (316)
CA	2.3 ± 3.9 (+11%) (26)	3.7 ± 3.2 (+18%) (10)	1.5 ± 4.2 (+7%) (16)
Stable angina	1.4 ± 3.1 (+7%) (29)	0.7 ± 2.5 (+5%) (7)	1.6 ± 3.3 (+8%) (22)
TAVR	-1.0 ± 2.1 (-8%) (3)	0.2 ± 0.8 (+2%) (2)	-3.3 (-20%) (1)

Abbreviations: CA, cardiac arrhythmia; CABG, coronary artery bypass graft; CHF, chronic heart failure; HVS, heart valve surgery; MI, myocardial infarction; PCI, percutaneous intervention; TAVR, transcatheter aortic valve replacement.

^aData are presented as mean ± SD (% improvement) (n). There was a significant interaction between baseline aerobic capacity and diagnosis ($P < .001$). Post hoc comparisons with LSD:

HVS vs MI,^b PCI,^b stable angina,^b CA,^c TAVR^c; CABG vs MI,^b PCI,^b stable angina,^b CA,^d TAVR^d; CHF vs stable angina^d; MI vs stable angina.^d

^bBetween-group $P < .001$.

^cBetween-group $P < .01$.

^dBetween-group $P < .05$.

❑ Gains de VO₂max ♀ < ♂ (Rengo 2020, Savage 2009, De Schutter 2018, Nguyen 2021)

❑ Expérience local (♀ +2,2ml/min/kg ; ♂ + 3,1 ml/min/kg)

❑ Pourquoi?!?

Rengo et coll 2020



NON Répondeurs

☐ Plus de femmes que d'hommes

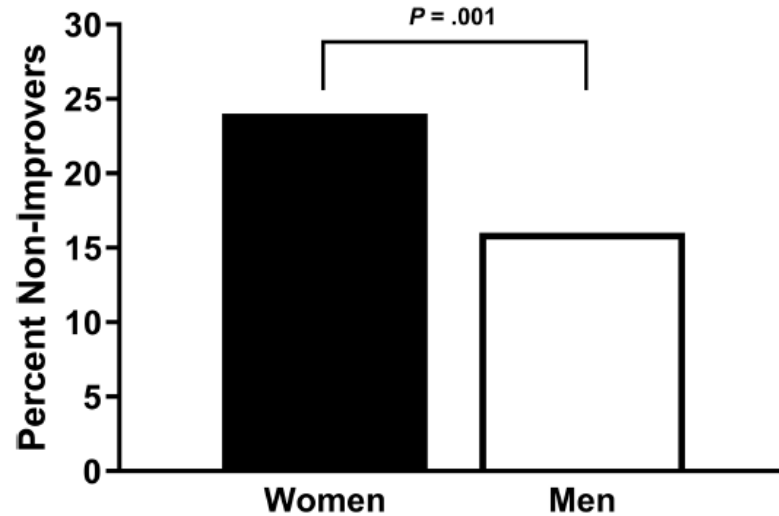


Figure. Percentage of patients who fail to improve aerobic capacity (women: n = 407; men: n = 1382) following cardiac rehabilitation.

Rengo et coll 2020



Moindre amélioration de la VO₂max: hypothèses

❑ Test parfois **sous maximaux**

- QR à 1,06 au départ (exercices sous maximaux) (Rengo et coll 2020)
- Fréquences cardiaques cibles (%) ou VO₂ sous estimée

❑ ♀ sont souvent plus âgés et plus de comorbidités donc tendance exercices plus **conservateurs**

❑ **Perceived exertion (PE)** ♀ (et non répondeurs) > ♂ pour une intensité similaire (Savage et coll 2009)

Table 2 • COMPARISON OF EXERCISE TRAINING PARAMETERS FOR TOTAL POPULATION AND “NONIMPROVERS” AND “IMPROVERS” BASED ON PEAK OXYGEN UPTAKE

	Range	Total (N = 385)	Nonimprovers (n = 81)	Improvers (n = 304)	P between groups
Cardiac rehabilitation sessions attended	2–36	24.0 ± 9.8	24.5 ± 10	23.8 ± 8.9	.66
Exercise training treadmill time, min	0–60	30.7 ± 6.8	29.6 ± 5.7	31.0 ± 7.0	.144
Exercise training ergometer time, min	0–50	24.2 ± 7.6	24.2 ± 7.5	24.2 ± 7.6	.99
Rating of perceived exertion	10–15	12.7 ± .8	12.6 ± .8	12.8 ± .8	.10
Training intensity, peak oxygen uptake, %	23–100	78 ± 13	72.7 ± 10.9	79.2 ± 12.5	.0002
Training intensity, peak heart rate, %	47–129	81 ± 11	79.0 ± 10.6	82.9 ± 10.4	.05

Moindre amélioration de la VO_2max : hypothèses

- Amélioration de la VO_2max et donc diminution du risque de mortalité,.... est corrélé à l'intensité de l'entraînement (lié aux EFX)

Table 4 • CORRELATES WITH PERCENTAGE CHANGE ON PEAK OXYGEN UPTAKE

	<i>r</i>	<i>R</i> ²	<i>P</i>
Exercise training intensity, peak oxygen uptake (peak $\dot{\text{V}}\text{O}_2$) ^a , %	.32	.10	<.0001
Exercise training intensity, peak heart rate, %	.21	.06	<.0002
Baseline comorbidity score ^a	-.20	.04	<.0001
Baseline peak $\dot{\text{V}}\text{O}_2$, ^a mL · kg ⁻¹ · min ⁻¹	-.17	.03	<.0006
Entry physical function score (Medical Outcomes Study Short Form-36) ^a	-.15	.03	<.004
Baseline handgrip strength, ^a kg	.14	.02	<.01
Diagnosis of diabetes mellitus ^a	-.13	.02	<.03
Female gender	-.13	.02	<.02

^aBy stepwise multivariate analysis, baseline comorbidity score, baseline peak $\dot{\text{V}}\text{O}_2$, entry physical function score, baseline handgrip strength, and diagnosis of diabetes mellitus independently correlated with percentage change in peak $\dot{\text{V}}\text{O}_2$ (cumulative total $r = 0.51$, adjusted $R^2 = 0.26$, $P < .0001$).

- Se baser sur l'échelle de Borg uniquement ?

Savage et coll 2009



Moindre amélioration de la VO₂max: hypothèse musculo squelettique

- D+ musculo squelettique:** arthrose, D+ articulaire,... (MSKC: MuSculosKeletal Comorbidities)
- Augmentent invalidité, incapacité fonctionnelle (Murray, Lancet, 2010)
- Chez >50% patients mais ♀>♂

Table 1: Sociodemographic, Clinical, and Psychosocial Characteristics of Those With and Without Musculoskeletal Comorbidities

Patient Characteristics	Total	MSKC	No MSKC	MSKC vs No MSKC (P)
Total, n (%)	1803	1010 (56.0)	793 (44.0)	NA
Sociodemographic				
Age (y)	65.4±10.4	66.8±10.2	63.7±10.4	<.001
Women, n (%)	448 (24.8)	311 (30.8)	137 (17.3)	<.001
Married, n (%)	1388 (77.7)	737 (73.7)	651 (82.7)	<.001
Living alone, n (%)	328 (18.8)	215 (22.1)	113 (14.7)	<.001
Education (<high school), n (%)	441 (25.2)	285 (29.2)	156 (20.3)	<.001
Retired, n (%)	903 (52.0)	555 (57.1)	348 (45.6)	<.001
Employed full-time, n (%)	493 (28.4)	223 (22.9)	270 (35.4)	<.001
Gross family income (<Can \$50,000), n (%)	728 (50.1)	454 (56.5)	274 (42.1)	<.001
Subjective socioeconomic status (<6.5 median split), n (%)	724 (44.4)	447 (48.8)	277 (38.8)	<.001
Rurality (>30min from hospital), n (%)	216 (12.0)	140 (13.9)	76 (9.6)	.003
Ethnicity (white), n (%)	1536 (88.5)	880 (90.6)	656 (85.8)	.002

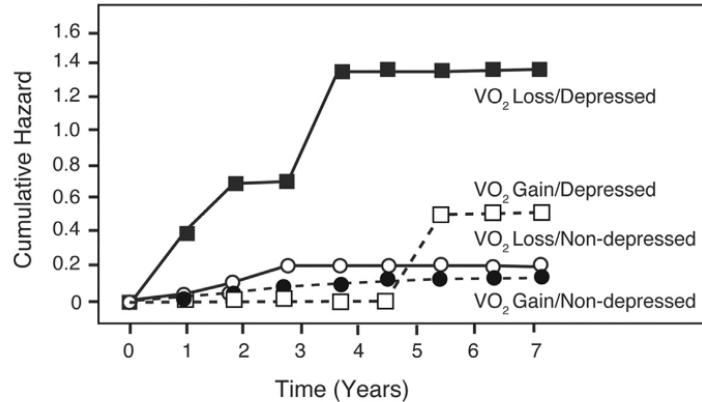
- Impact négatif** sur capacité/intensité à faire exercices et potentiellement son gain de VO₂

Marzolini et coll 2012



Moindre amélioration de la VO₂max: hypothèse psychologique

- ❑ Lien entre détresse psychologique et maladie CV
- ❑ Dépression, anxiété,...
- ❑ Taux dépression ♀ > ♂ (Josephon 2006, Koh 2019, Terada 2021)
- ❑ Risque de mortalité augmenté

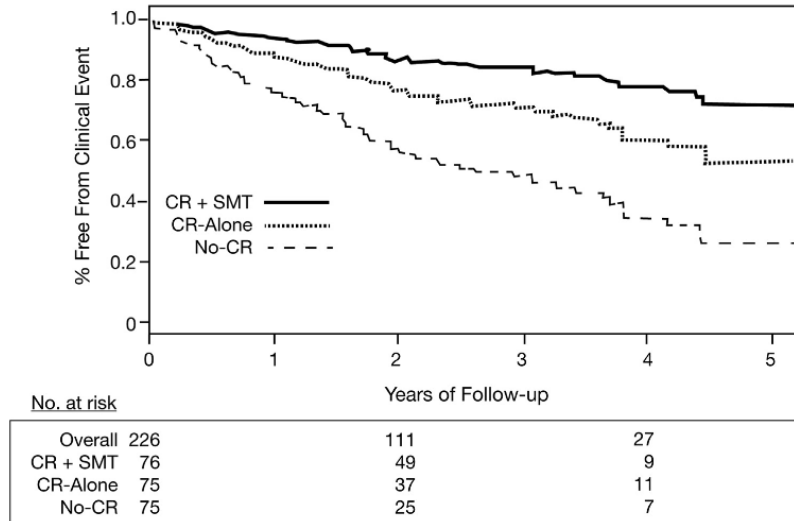


No. at Risk	0	1	2	3	4	5	6	7
VO ₂ loss/Depressed	6	4	3	2	1	1	1	1
VO ₂ gain/Depressed	8	7	6	4	3	3	1	1
VO ₂ loss/Non-Depressed	24	21	18	13	11	9	7	5
VO ₂ gain/Non-Depressed	90	86	78	67	60	52	41	33

Figure 4. Actuarial hazard for death comparing patients with heart failure with and without depression stratified by change in oxygen uptake after exercise training ($P < 0.01$ between oxygen uptake loss/depressed and all others). Reproduced from Miliani et al.⁵¹ with permission from Elsevier.

Moindre amélioration de la VO₂max: hypothèses

- ❑ Importance d'un travail **pluridisciplinaire!**
- ❑ **Evaluation psychologique** chez tous mais surtout aussi chez la ♀



CR: Cardiac rehabilitation
SMT: Stress Management training

- ❑ Diminue de taux d'hospitalisation, de drop out et augmente l'adhérence

Lavie et coll 2016



Résumé des constats

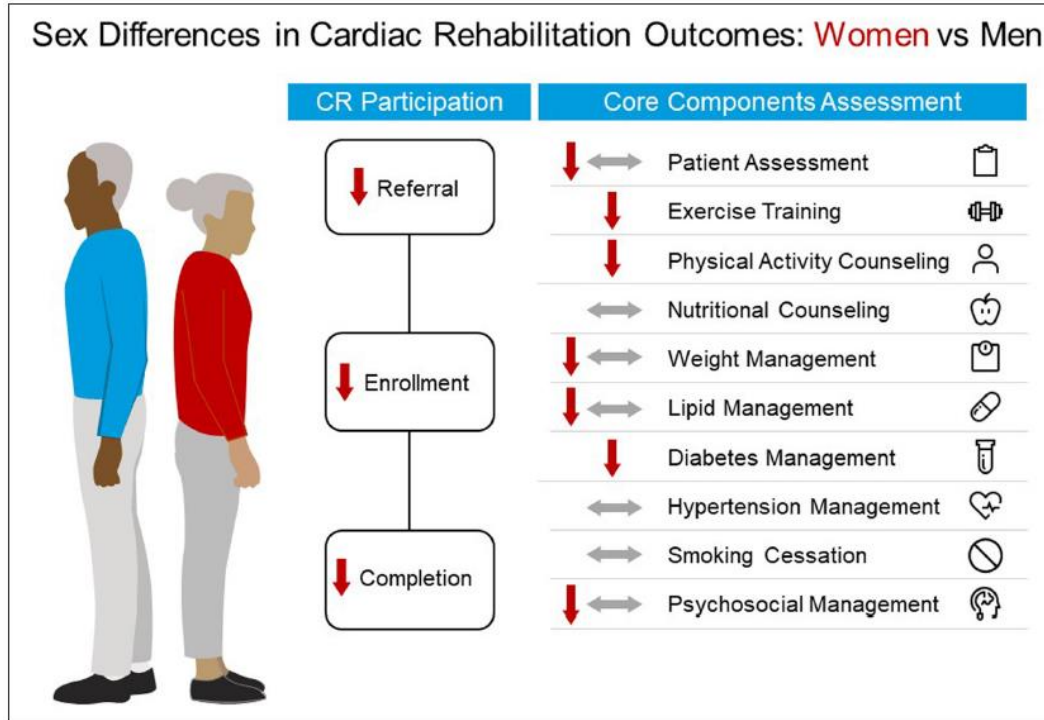


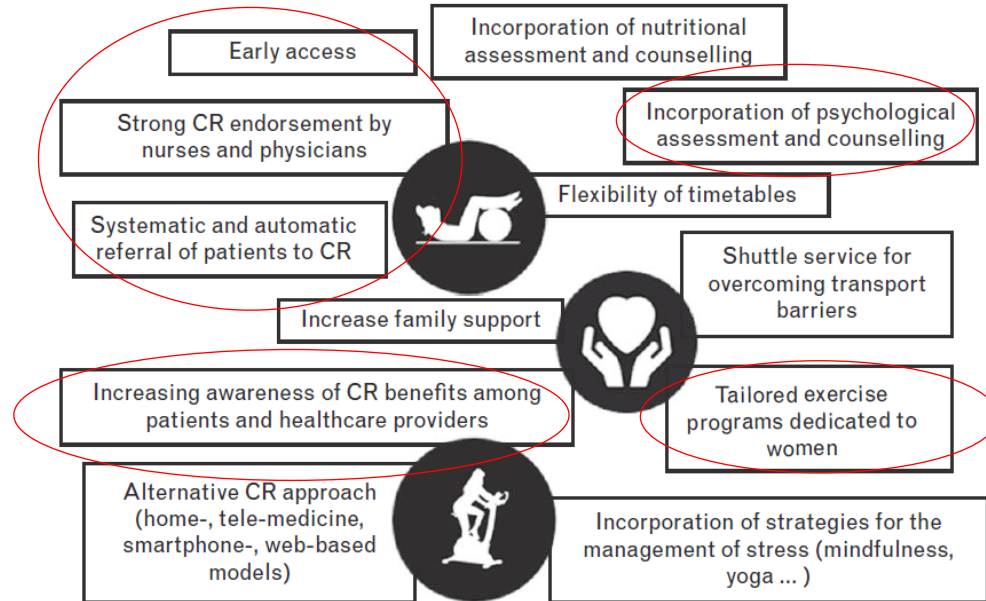
Figure. This summary figure illustrates the occurrence of sex differences in cardiac rehabilitation (CR) participation as well as the core components of CR, based on the studies described herein.

The down arrow represents a poorer outcome for females compared with males. The bidirectional arrow represents either a similar outcome between the sexes or that inadequate data is available on sex-specific differences for that outcome.

Smith et al 2022

Résumé solutions/stratégies

Cardiac rehab in women:
strategies to overcome the current barriers



Proposed strategies to overcome the current barriers to cardiac rehabilitation in women.

Merci pour votre attention

Kevin.forton@hubruxelles.be

Galati et coll 2018

