Entraînement à haute intensité

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POUR *ou contre*

Conflit d’intérêt

- Kinésithérapeute hospitalier

Pulmonary rehabilitation is a comprehensive intervention … which include, but are not limited to, exercise training, education and behavior change, designed to improve the physical and emotional condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors.

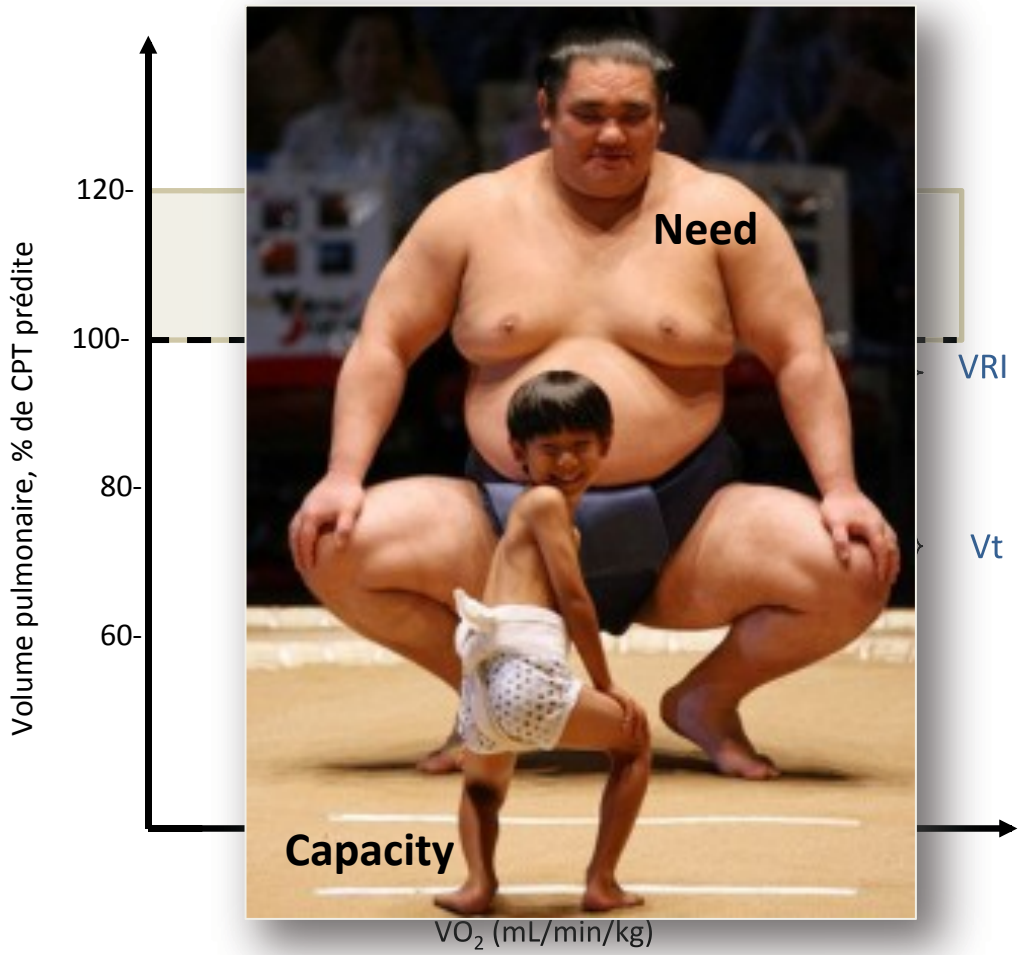
Objectifs : réduire les symptomes et améliorer l'état fonctionnel, la qualité de vie et la participation aux AVJ

ERS EUROPEAN RESPIRATORY SOCIETY
every breath counts

AMERICAN THORACIC SOCIETY 1905 ATS
We help the world breathe
PULMONARY • CRITICAL CARE • SLEEP

Limitations à l'effort

- Ventilatoire
- Dysfonction musculaire
- Echanges gazeux
- Cardiaque



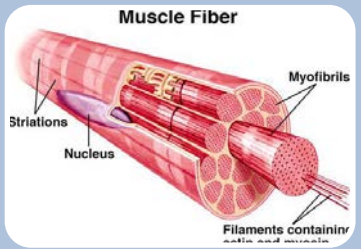
Cause d’arrêt de l’exercice

Inconfort respiratoire

- 61%

Inconfort respiratoire et musculaire (MI)

- 19%



Inconfort musculaire (MI)

- 18%

Haute intensité…
C’est quoi ça?

Haute intensité c’est …
intensité de 60% ou plus
de la capacité maximale
déterminée lors d’une
EFX


Faisable?

Faisable?

Intensity of Training and Physiologic Adaptation in Patients with Chronic Obstructive Pulmonary Disease

FRANÇOIS MALTAIS, PIERRE LEBLANC, JEAN JOBIN, CHANTAL BÉRUBÉ, JOAN BRUNEAU, LINDA CARRIER, MARIE-JOSÉE BRETON, GENEVIÈVE FALARDEAU, and ROGER BELLEAU

« The purposes of this study were to evaluate: (1) the proportion of patients with moderate to severe COPD in whom high intensity training is feasible… »

Age	65.5 ± 7.3
Sex, M/F	29/13
Height, m	1.65 ± 0.08
Weight, kg	67.9 ± 15.2
FEV_1, L	0.97 ± 0.33
FEV_1, %pred	38.3 ± 12.6
FVC, L	2.42 ± 0.75
FVC, %pred	64.6 ± 17.5
TLC, %pred	128.0 ± 28.6
DLCO, %pred	69.8 ± 26.1
Pa_{O_2}, mm Hg	79.9 ± 10.9
Pa_{CO_2}, mm Hg	43.8 ± 8.1

At week 12, the mean exercise intensity was only 60% of maximal workrate

High-intensity training was achieved in 0, 3, 5, and 5 patients (/42) at weeks 2, 4, 10, and 12, respectively

Exercice : 25-30’ – 3x/sem – 12 sem
Intensité : 80% Wmax

Am J Respir Crit Care Med 1997;155:555-561

Faisable?

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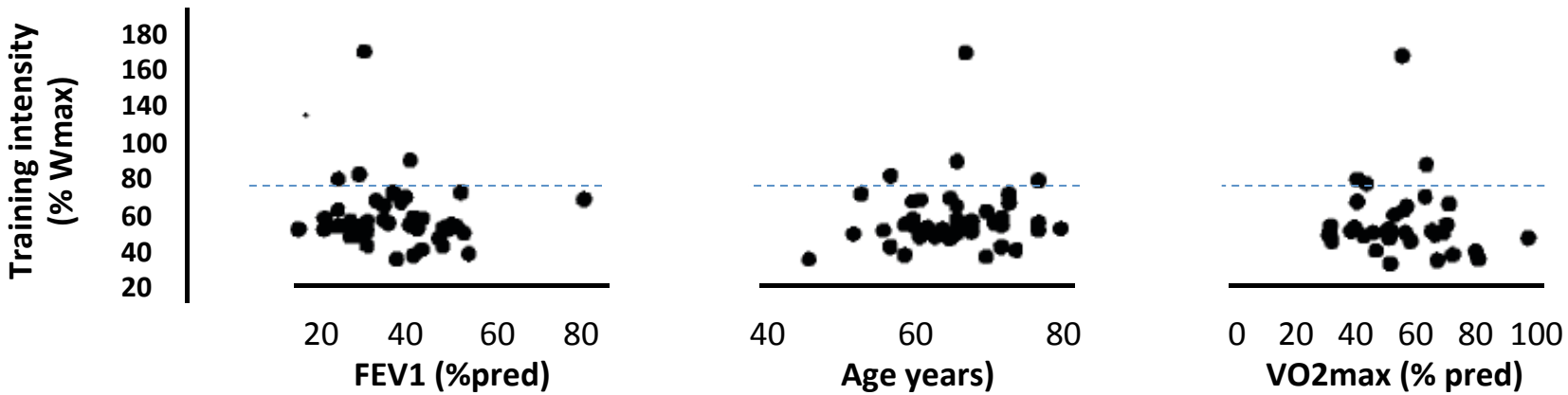


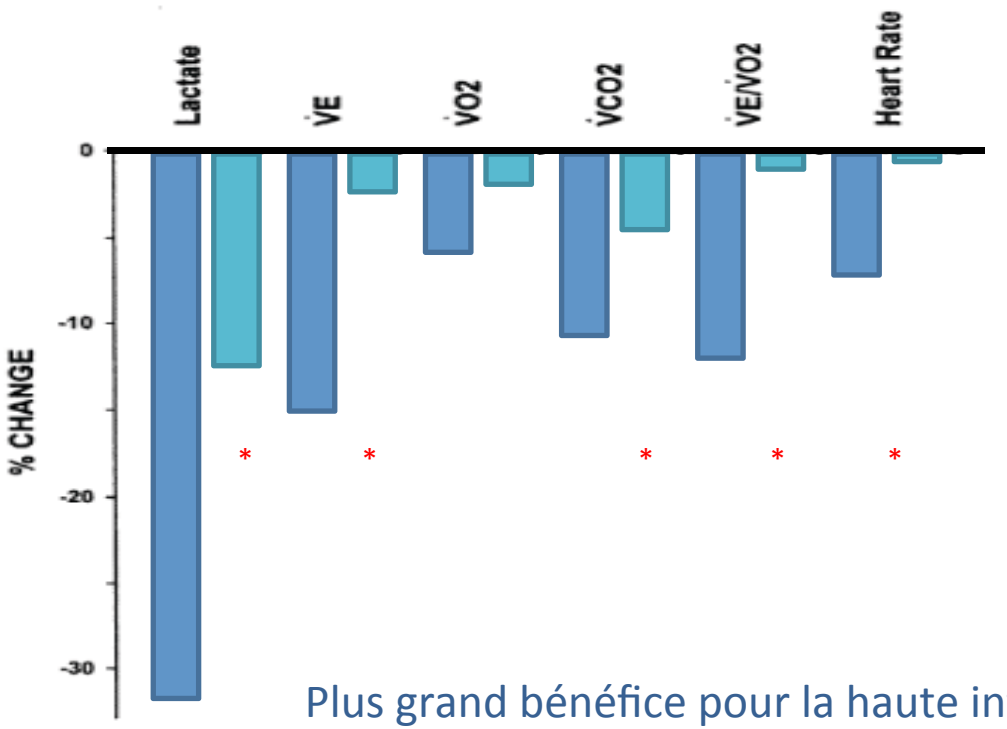
Am J Respir Crit Care Med 1997;155:555-561


Le travail à haute intensité, ça fonctionne?

Ca fonctionne?

	High work rate (n=11)	Low work rate (n=8)
Age, yr	49 ± 11	54 ± 8
Weight, kg	72 ± 15	69 ± 10
Height, cm	169 ± 6	166 ± 4
FEV_1, L	1.87 ± 0.53	1.74 ± 0.47
FEV_1 % predicted	56 ± 14	56 ± 12
FVC, L	3.23 ± 0.54	2.99 ± 0.62
Pa_{O_2}, mm Hg	84 ± 9	81 ± 11
Pa_{CO_2}, mm Hg	41 ± 5	39 ± 4
pHa	7.44 ± 0.03	7.44 ± 0.03
Blood pressure, mm Hg	133/81 ± 11/6	133/79 ± 18/9

Exercices : 5x/sem – 8 sem
Intensité : 71W vs 30W
Durée : 45 min/j vs 45 min x high work rate/low work rate)



Plus grand bénéfice pour la haute intensité

Physiological measurements from constant workrate testing, before and after exercise training: high work rate training group; low work rate training group.

Adapté de Casaburi R et al. Am Rev Respir Dis 1991

Ca fonctionne?

An Evaluation of Two Approaches to Exercise Conditioning in Pulmonary Rehabilitation*

Edgar A. Normandin, PhD; Corliss McCusker, RN; MaryLou Connors, RN; Frederick Vale, RRT; Daniel Gerardi, MD, FCCP; and Richard L. ZuWallack, MD, FCCP

Table 3 Changes in selected variables following high and low intensity exercise training (from Normandin *et al.*[18])

Variable	*High*	*P versus baseline*	*Low*	*P versus baseline*	*P high versus low*
Treadmill endurance (min)	8.4	<0.001	2.7	0.07	0.007 *
VO_2 peak (L min^{-1})	0.11	0.02	0.00	0.99	0.09
VE/VO_2 @ 80% of WR	−2.48	0.008	−1.59	0.08	0.48
VAS dyspnea (% line length)	−45	<0.001	−14	0.12	0.02 *
Arm lifts (lifts/min)	6.5	0.001	12.2	<0.001	0.04
CRQ[a] total score (units)	11.5	<0.001	18.8	<0.001	0.09
TDI[b] (units)	2.9	<0.001	3.2	<0.001	0.69

[a]Chronic Respiratory Disease Questionnaire; [b]Transition Dyspnea Index.

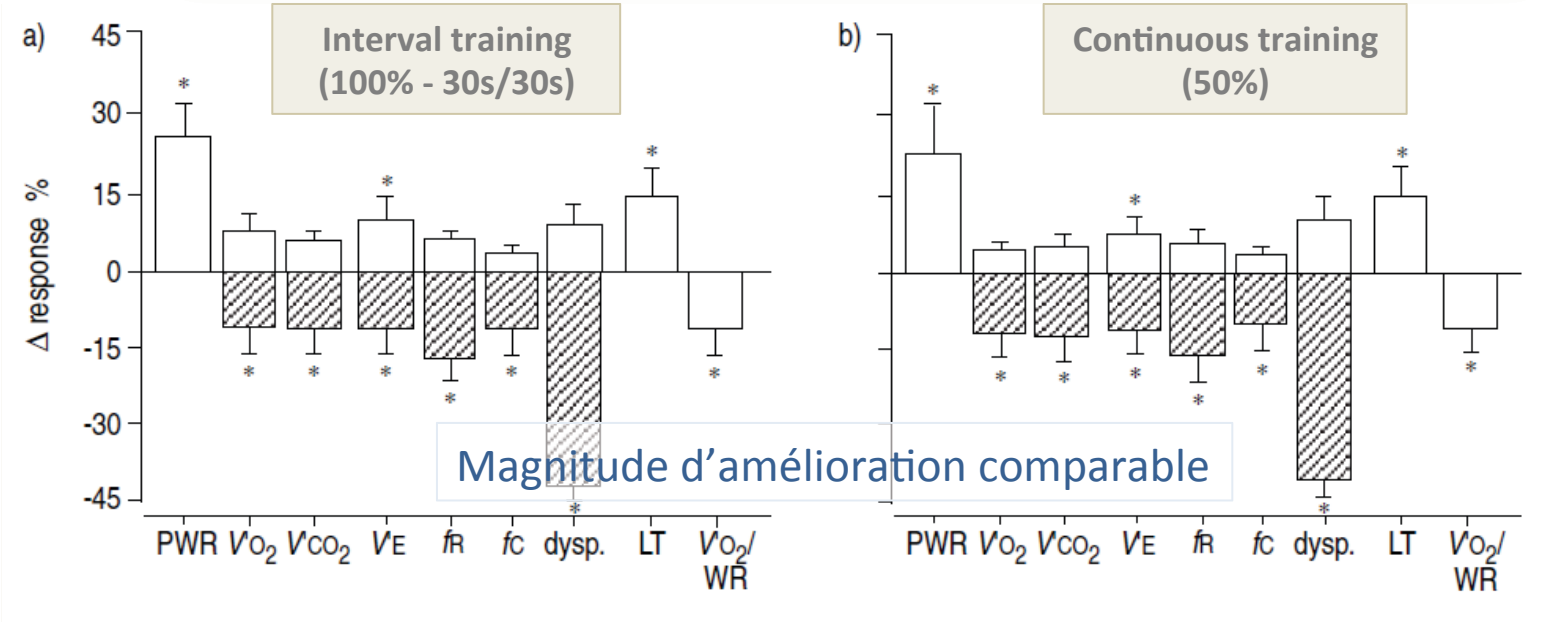
Exercice : 30’ à 80% – 2x/sem – 8 sem

Chest 2002; 121:1085-91

Ça fonctionne?

Interval training as an alternative modality to continuous exercise in patients with COPD

I. Vogiatzis, S. Nanas, C. Roussos



Difference (Δ) in physiological responses at baseline peak work-rate (PWR; ☐) and at an identical work-rate (WR; ■) from initial PWR exercise during the incremental cycle ergometer test.
VO2: oxygen uptake; VCO2: carbon dioxide output; VE: minute ventilation; fR: respiratory frequency; fC: cardiac frequency; dysp.: end-exercise dyspnoea score; LT: lactate threshold; VO2/WR: slope of VO2/WR. *: $p<0.05$ within group.

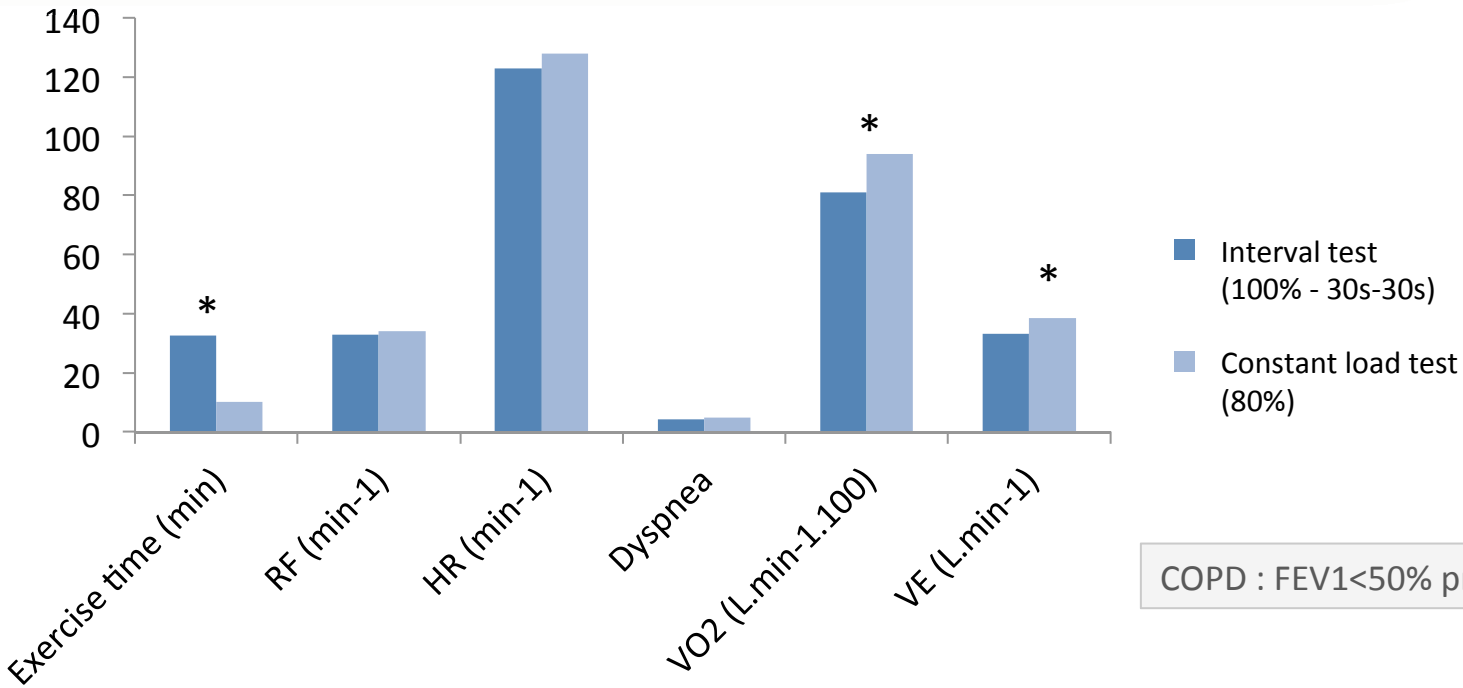
Eur Respir J 2002; 20: 12–19

Comment la rendre accessible à tous?

Interval training

Dynamic hyperinflation and tolerance to interval exercise in patients with advanced COPD

I. Vogiatzis*,#, S. Nanas*, E. Kastanakis¶, O. Georgiadou#, O. Papazahou*, Ch. Roussos*



COPD : FEV1<50% pred

Data are presented as mean. RF: breathing frequency; HR: cardiac frequency; VO2: oxygen uptake; VE: minute ventilation.
*: significant differences between IE and CT

Eur Respir J 2004; 24: 385–390

Interval training

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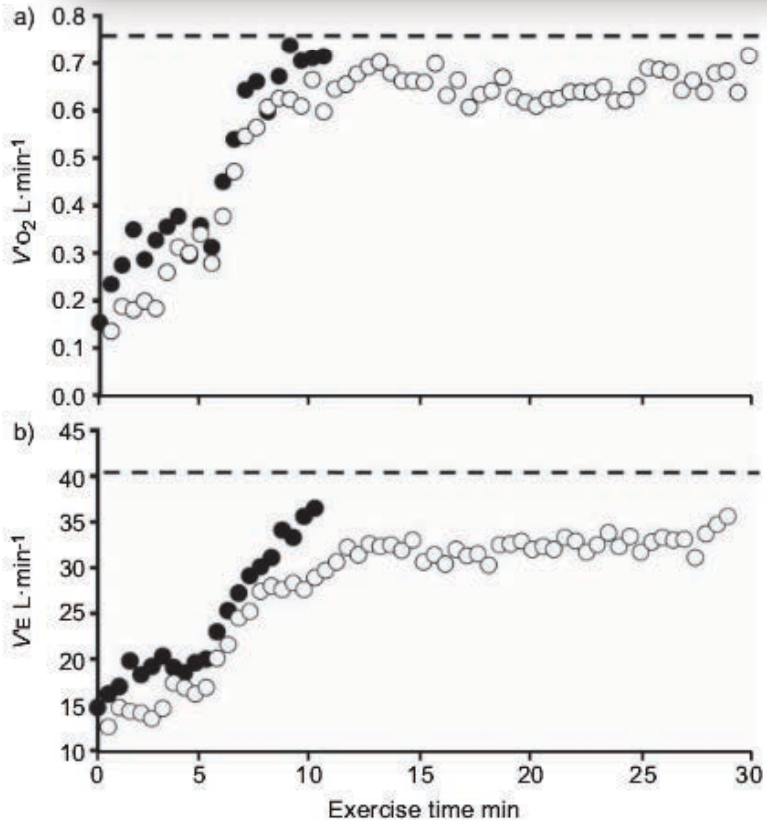
I. Vogiatzis*,#, S. Nanas*, E. Kastanakis¶, O. Georgiadou#, O. Papazahou*, Ch. Roussos*



a) Oxygen uptake (VO2) and b) minute ventilation (VE) in a patient with severe chronic obstructive pulmonary disease during interval (○) and constant-load (●) exercise protocols. Interval exercise was sustained for 30 s at 100% of peak baseline capacity alternated with 30 s rest, whereas constant-load exercise was sustained at 75% of peak baseline capacity.

– – – – – peak VO2 or maximal voluntary ventlation.

Eur Respir J 2004; 24: 385–390

Interval training

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Table 4. – Responses to interval exercise at temporally matched time points between work and unloaded pedalling phases

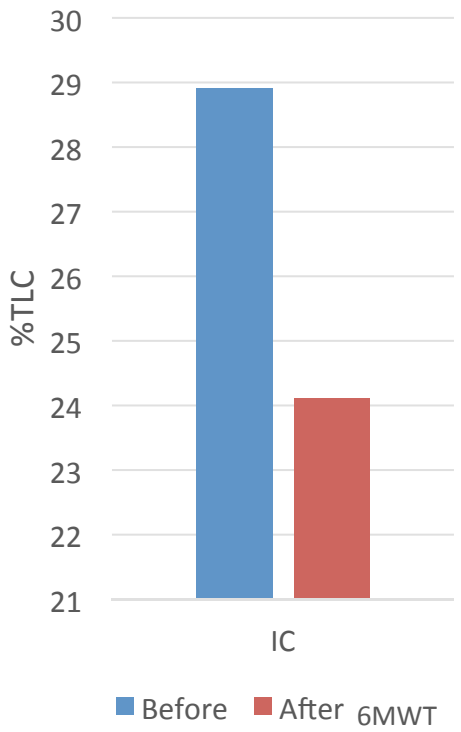
	30% total time		60% total time		90% total time		CLE
	Work phase	Unloaded phase	Work phase	Unloaded phase	Work phase	Unloaded phase	
$V'O_2$ L·min^{-1}	0.74±0.04	0.74±0.04	0.77±0.05	0.77±0.05	0.78±0.04	0.78±0.05	0.94*
$V'E$ L·min^{-1}	31.1±1.6	31.0±1.5	32.0±1.8	32.0±2.0	32.7±2.2	32.3±2.0	38.4*
fC beats·min^{-1}	113±5	114±6	118±5#	118±7	120±4#	120±5	128
IC L	1.55±0.08		1.61±0.08		1.59±0.08		1.53
Dyspnoea Borg	2.9±0.2		3.3±0.3#		4.3±0.4#		4.8
Leg discomfort Borg	3.1±0.3		3.6±0.4#		4.6±0.5#		4.9

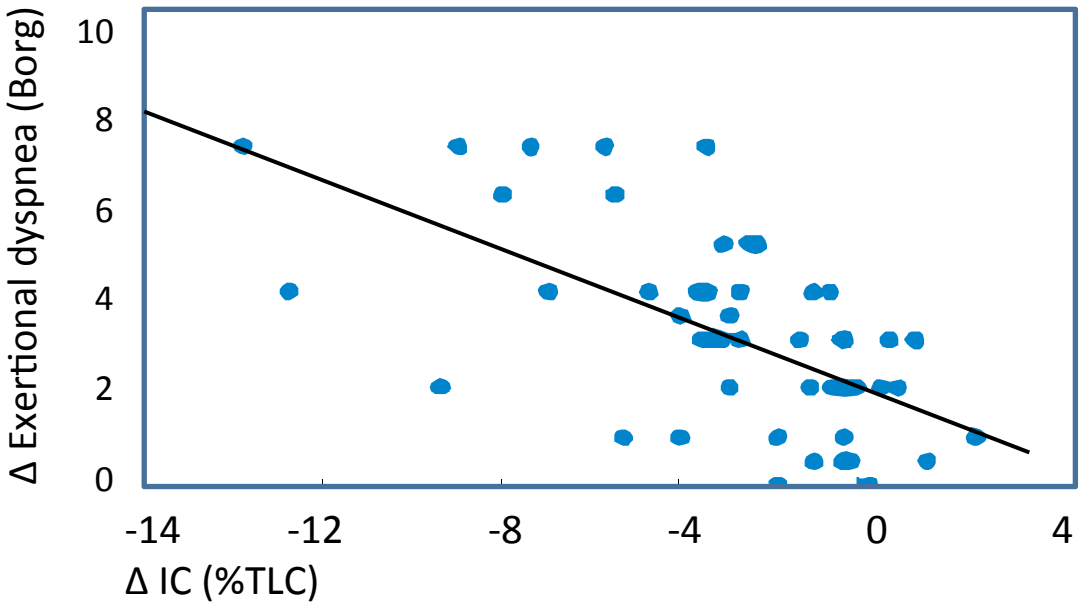
IC = 1,98L at baseline

Eur Respir J 2004; 24: 385–390

Inspiratory Capacity, Dynamic Hyperinflation, Breathlessness, and Exercise Performance during the 6-Minute-Walk Test in Chronic Obstructive Pulmonary Disease

JOSÉ M. MARIN, SANTIAGO J. CARRIZO, MANUEL GASCON, ANDRES SANCHEZ, BEGOÑA GALLEGO, and BARTOLOMÉ R. CELLI

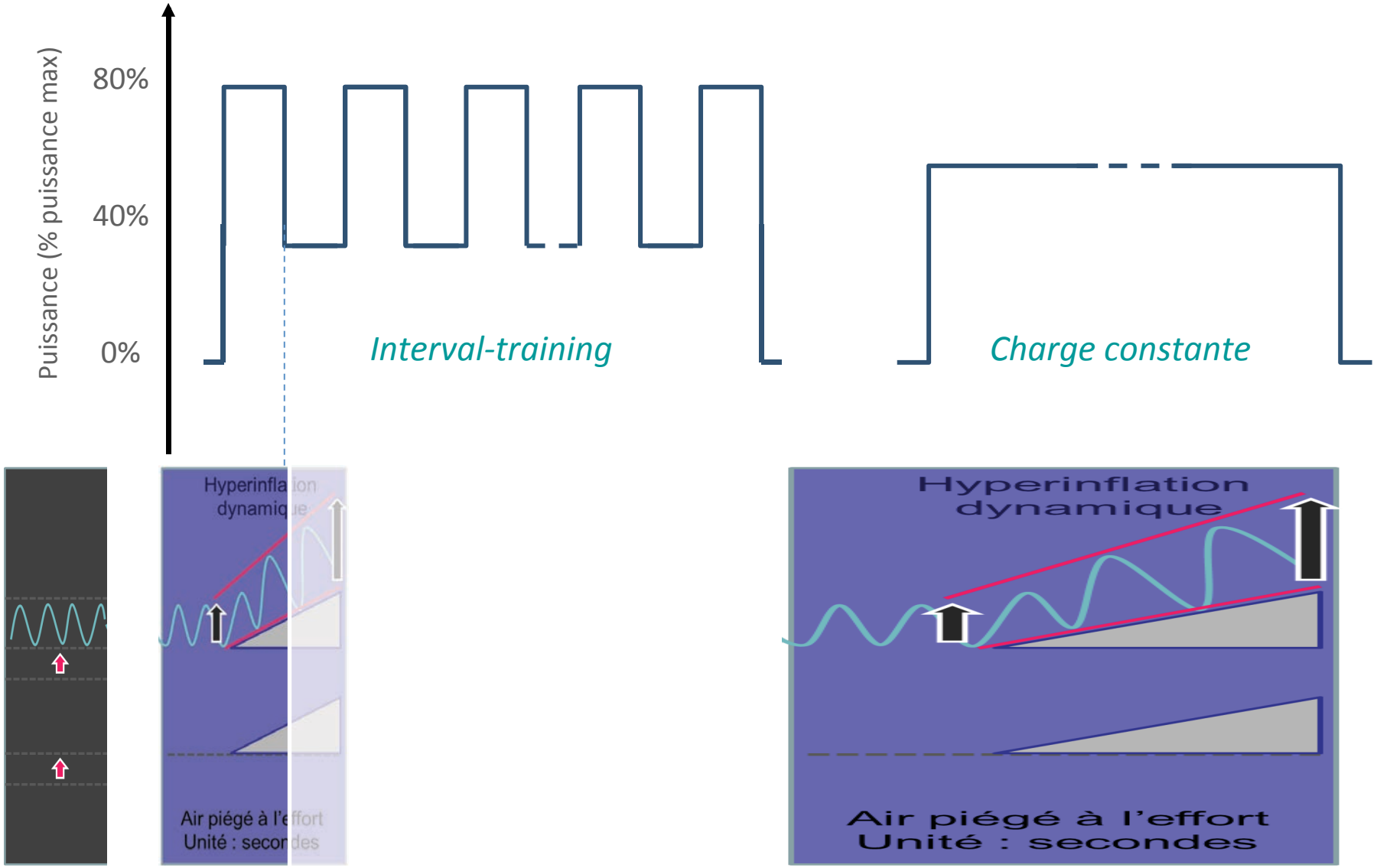




Relationship between the change in Borg breathlessness rating and change in IC from rest to the end of the 6MWD ($r = -0.49$, $p < 0.00001$)

Am J Respir Crit Care Med 2001;163:1395–1399

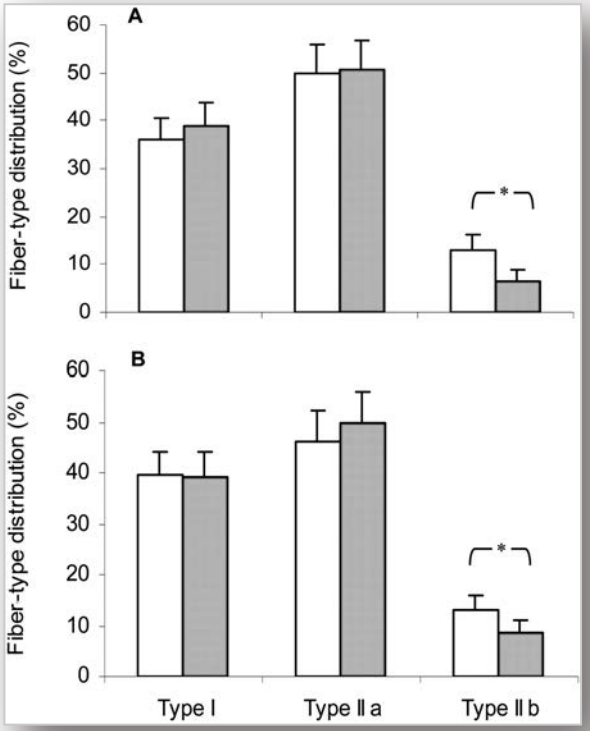
Hyperinflation et interval training



Interval training

Skeletal Muscle Adaptations to Interval Training in Patients With Advanced COPD*

Ioannis Vogiatzis, PhD; Gerasimos Terzis, PhD; Serafeim Nanas, MD; Grigoris Stratakos, MD; Davina C. M. Simoes, PhD; Olga Georgiadou, MSc; Spyros Zakynthinos, MD; and Charis Roussos, MD, PhD



Interval-training
30s/30s – 100% Wmax
3x/sem

Charge constante
60% Wmax
3x/sem

Vogiatzis I et al. Chest 2005;128:3838-3845

Interval training

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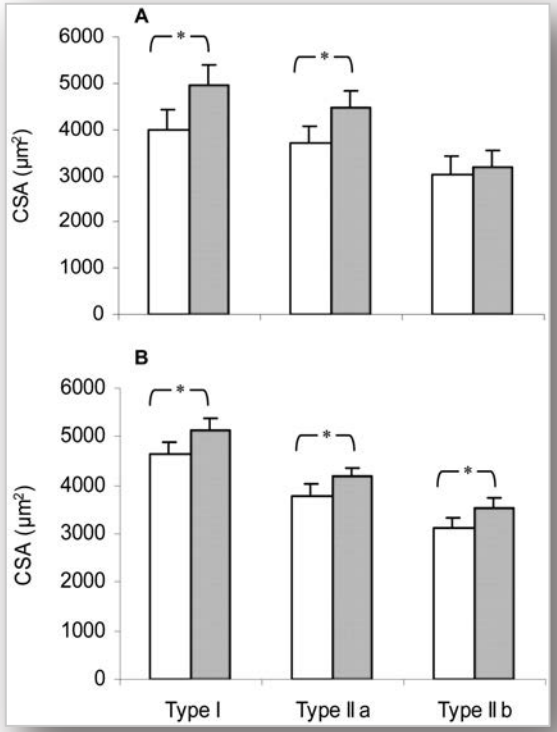

Interval-training
30s/30s – 100% Wmax
3x/sem

Charge constante
60% Wmax
3x/sem

Effet sur la structure
Changement similaire de la section et de la proportion du type de fibre entre les deux types d'entraînement

Vogiatzis I et al. Chest 2005;128:3838-3845

Avantage de l'*Interval training*

Skeletal Muscle Adaptations to Interval Training in Patients With Advanced COPD*

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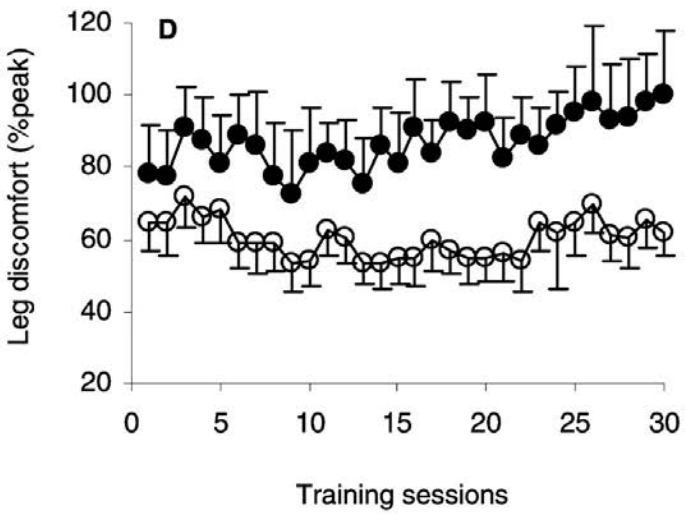
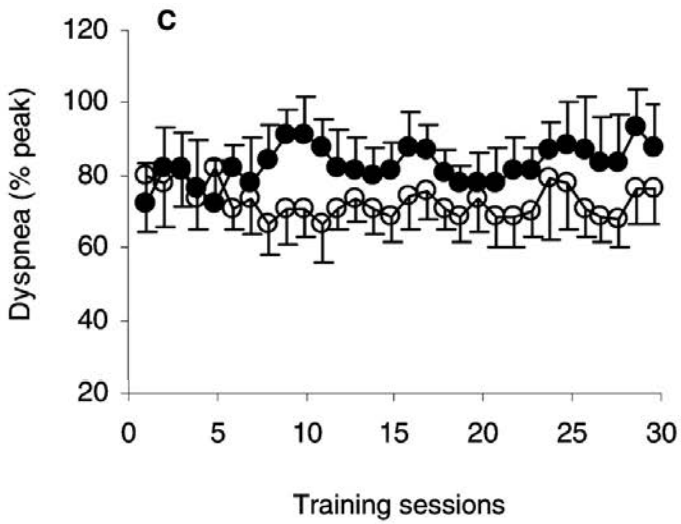
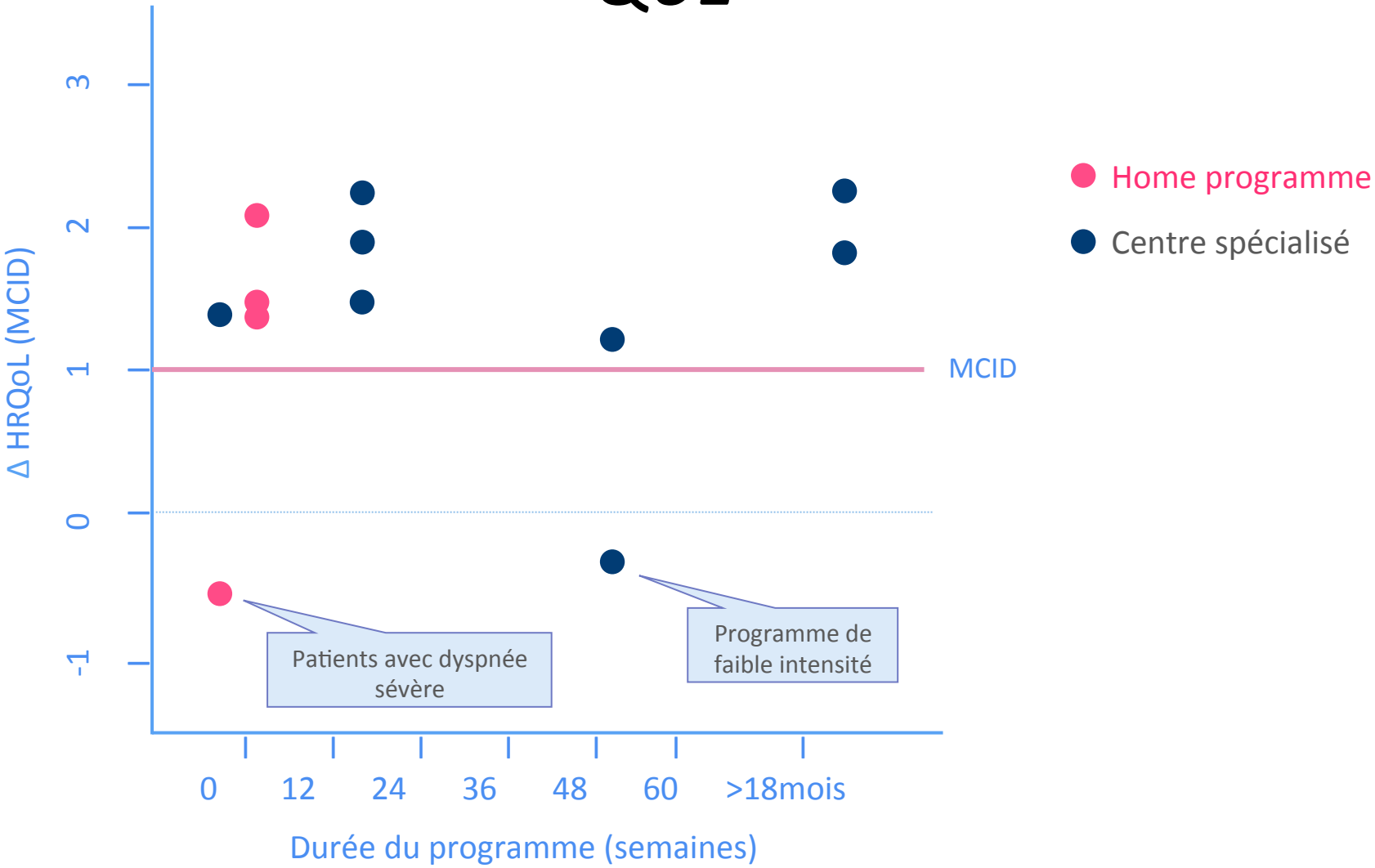




○ Interval-training
● Entrainment à charge constante

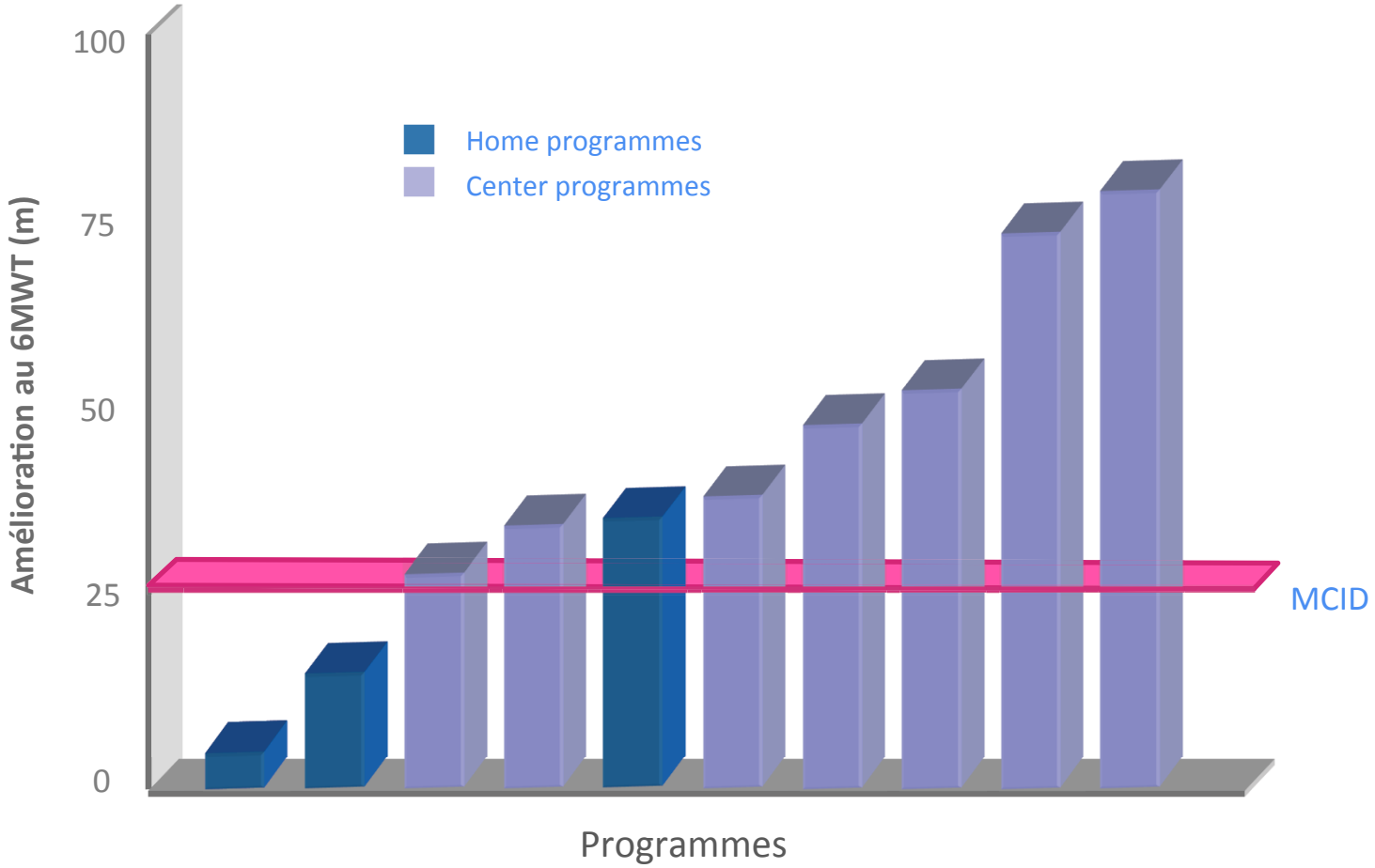
Vogiatzis I et al. Chest 2005;128:3838-3845

Bénéfices
QoL



Troosters T et al. Am J Respir Crit Care Med 2005;172:19–38

Bénéfices
Tolérance à l'effort



Troosters T et al. Am J Respir Crit Care Med 2005;172:19–38

- Motivation moindre pour intensité élevée?

- Adhérence meilleure pour intensité faible?

Eur Respir Rev 2013; 22: 128, 178–186
DOI: 10.1183/09059180.00000513

Conclusion

SERIES "THEMATIC REVIEW SERIES ON PULMONARY REHABILITATION"
Edited by M.A. Spruit and E.M. Clini
Number 1 in this Series

TABLE 2 Practical recommendations for the implementation of continuous and interval endurance training programmes

	Continuous endurance training	Interval endurance training
Frequency	3–4 days·week^{-1}	3–4 days·week^{-1}
Mode	Continuous	Interval modes: 30 s of exercise, 30 s of rest or 20 s of exercise, 40 s of rest
Intensity	Initially 60–70% of PWR	Initially 80–100% of PWR for the first three to four sessions
	Increase work load by 5–10% as tolerated	Increase work load by 5–10% as tolerated
	Progressively try to reach ~80–90% of baseline PWR	Progressively try to reach ~150% of baseline PWR
Duration	Initially 10–15 min for the first three to four sessions	Initially 15–20 min for the first three to four sessions
	Progressively increase exercise duration to 30–40 min	Progressively increase exercise duration to 45–60 min (including resting time)
Perceived exertion	Try to aim for a perceived exertion on the 10-point Borg scale of 4 to 6	Try to aim for a perceived exertion on the 10-point Borg scale of 4 to 6
Breathing technique	Suggest pursed-lip breathing or the use of PEP devices to prevent dynamic hyperinflation and to reduce breathing frequency	Suggest pursed-lip breathing or the use of PEP devices to prevent dynamic hyperinflation and to reduce breathing frequency

PWR: peak work rate; PEP: positive expiratory pressure. Adapted from [30].

Merci…et votez POUR!