

High-intensity interval training @home

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Declaration of interest

- I have nothing to declare

Home-Based Aerobic Interval Training Improves Peak Oxygen Uptake Equal to Residential Cardiac Rehabilitation: A Randomized, Controlled Trial

Trine Moholdt^{1,2*}, Mona Bekken Vold³, Jostein Grimsmo³, Stig Arild Slørdahl⁴, Ulrik Wisloff¹

2012

- 30 patients after CABG
- Age 63, 24 men/6 women
- Included 8 weeks after surgery
- Followed 6 months

	Residential rehabilitation (n = 14)				Home-based aerobic interval training (n = 12)		
	Baseline	4 weeks	Follow-up	EMM (95% CI)	Baseline	Follow-up	EMM (95% CI)
Exercise test							
VO ₂ peak (mL·kg ⁻¹ ·min ⁻¹)	25.6±4.0	28.5±4.4*	30.2±4.3*	4.7 (2.9, 6.5)	23.8±5.4	27.7±6.5*	3.8 (1.9, 5.7)
VO ₂ peak (mL·min ⁻¹)	1076±429	2198±493*	2310±513*	335 (189, 481)	2016±555	2387±619*	370 (212, 527)
RER at VO ₂ peak	1.16±0.09	1.19±0.08	1.17±0.06	0.03 (-0.02, 0.08)	1.11±0.06	1.11±0.10	-0.03 (-0.07, 0.02)
HRR, 1 min	21.1±10.3	25.2±9.5	24.8±13.3	4.5 (-2.5, 11.6)	10.9±6.5	24.8±11.5*	12.4 (4.2, 20.6)
Perceived exertion	17±1.2	17.3±1.3	17.5±1.4	0.56 (-0.14, 1.26)	16.5±1.2	16.7±1.3	0.02 (-0.74, 0.77)



**Cochrane
Library**

Cochrane Database of Systematic Reviews

Conclusion: «....seems to be similarly effective in improving clinical and health-related quality of life outcomes in patients after myocardial infarction or revascularisation, or with heart failure»

Home-based versus centre-based cardiac rehabilitation (Review)

Anderson L, Sharp GA, Norton RJ, Dalal H, Dean SG, Jolly K, Cowie A, Zawada A, Taylor RS

2017

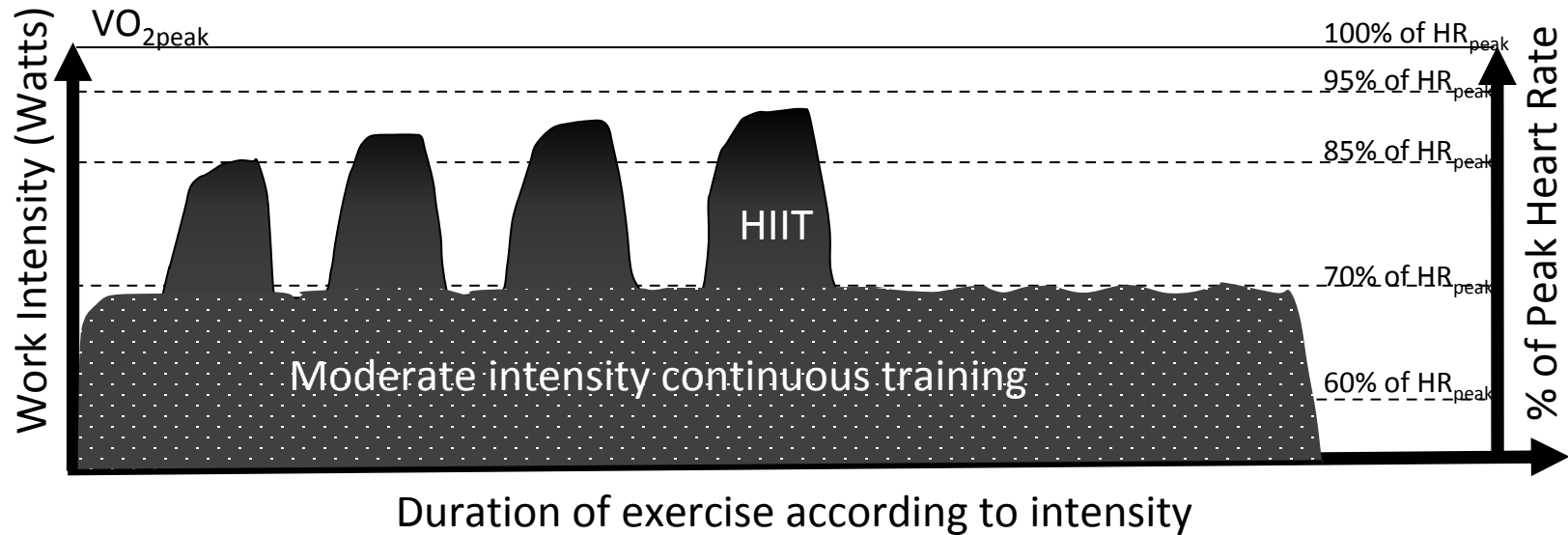


Table 1 Classification of exercise intensity for aerobic exercise

Intensity	% of HRR or %VO ₂ R	% HRmax	% VO ₂ max	Perceived exertion (Borg scale 6-20)
Very light	<30	<57	<37	RPE<9
Light	30-39	57-63	37-45	RPE 9-11
Moderate	40-59	64-76	46-63	RPE 12-13
Vigorous	60-89	77-95	64-90	RPE 14-17
Near-maximal to maximal	≥ 90	≥96	≥91	RPE ≥18

Garber et al. MSSE 2011

Why HIIT?

- Exercise at high intensity may induce larger health benefits than exercise at moderate intensity (Rankin et al. Scott Med J 2012, Shiroma et al. J Am Heart Assoc. 2014)
- Inverse dose-response relationship between proportion of vigorous physical activity and mortality (Gebel et al. JAMA Intern Med 2015)
- Exercise at high intensity improves peak oxygen uptake (VO_{2peak}) more than exercise at moderate intensity in people with CAD and HF (Uddin et al. Eur J Prev Cardiol. 2016)
- VO_{2peak} is a strong independent predictor of mortality (Keteyian et al. Am Heart J 2008, Vanhees et al. J Am Coll Cardiol. 1994)

Aerobic interval training and continuous training equally improve aerobic exercise capacity in patients with coronary artery disease: The SAINTEX-CAD study[☆]



Viviane M. Conraads^{a,b,1}, Nele Pattyn^{c,2}, Catherine De Maeyer^{a,b,2}, Paul J. Beckers^{a,b}, Ellen Coeckelberghs^c, Véronique A. Cornelissen^c, Johan Denollet^{a,d}, Geert Frederix^{a,e}, Kaatje Goetschalckx^{c,f}, Vicky Y. Hoymans^{a,b,e}, Nadine Possemiers^a, Dirk Schepers^c, Bharati Shivalkar^{a,b}, Jens-Uwe Voigt^f, Emeline M. Van Craenenbroeck^{a,b,e}, Luc Vanhees^{c,f,*}

Int J Cardiol 2015

Circulation



Conclusion

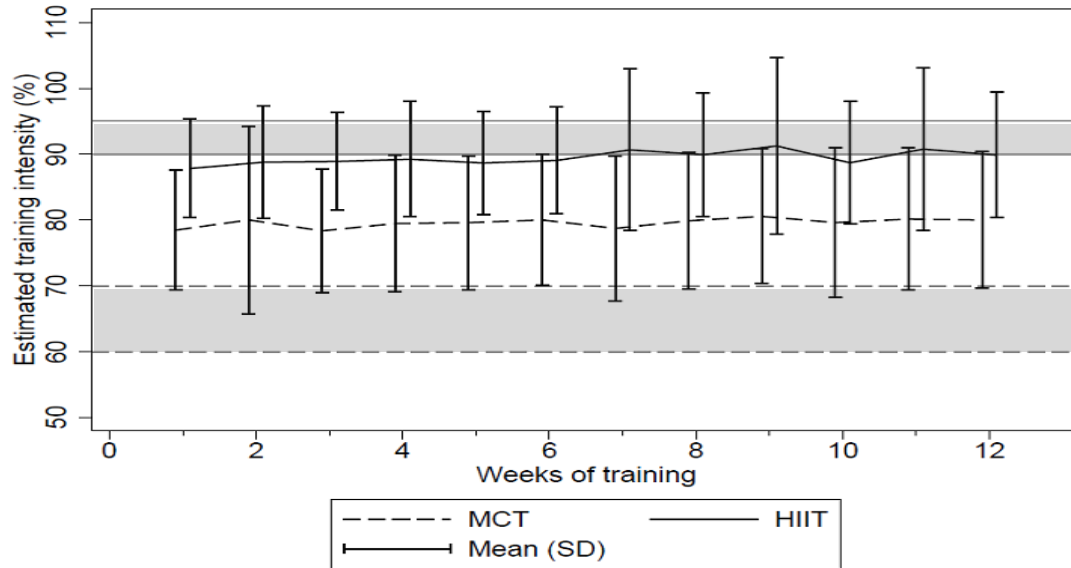
- Equally effective
- HIIT is safe
- HIIT is not feasible

High-Intensity Interval Training in Patients With Heart Failure With Reduced Ejection Fraction

Øyvind Ellingsen, Martin Halle, Viviane Conraads, Asbjorn Stoylen, Håvard Dalen, Charles Delagardelle, Alf-Inge Larsen, Torstein Hole, Alessandro Mezzani, Emeline M. Van Craenenbroeck, Vibeke Videm, Paul Beckers, Jeffrey W. Christle, Ephraim Winzer, Norman Mangner, Felix Woitek, Robert Höllriegel, Axel Pressler, Tea Monk-Hansen, Martin Snoer, Patrick Feiereisen, Torstein Valborgland, John Kjekshus, Rainer Hambrecht, Stephan Gielen, Trine Karlsen, Eva Prescott and Axel Linke
For the SMARTEx Heart Failure Study (Study of Myocardial Recovery After Exercise Training in Heart Failure) Group

Circulation. 2017;135:839-849; originally published online January 12, 2017;

Relative training intensity



HIIT: 51% below target heart rate
MCT: 80% above target heart rate

Ellingsen et al. Circulation 2017

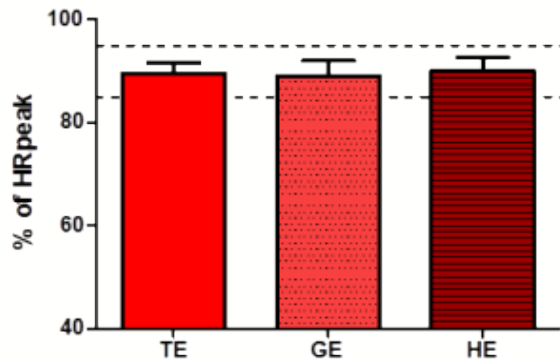
Home-based versus hospital-based high-intensity interval training in cardiac rehabilitation: a randomized study

Inger-Lise Aamot^{1,2}, Siv Hege Forbord², Kjersti Gustad³, Vibeke Løckra², Andreas Stensen³, Astrid Tarlebo Berg², Håvard Dalen^{1,3}, Trine Karlsen¹ and Asbjørn Støylen^{1,2}

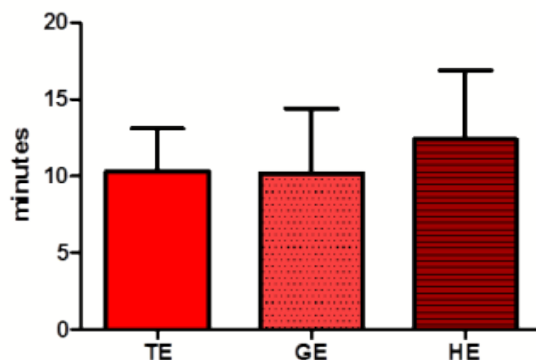
Q: Is HIIT feasible and effective in a clinical setting?

- n=90, age 58, 12% women
- HIIT 2 x week, 12 weeks
- Randomized to treadmill, group exercise or home-based HIIT
- Self-monitoring, instruction and feedback

Exercise intensity

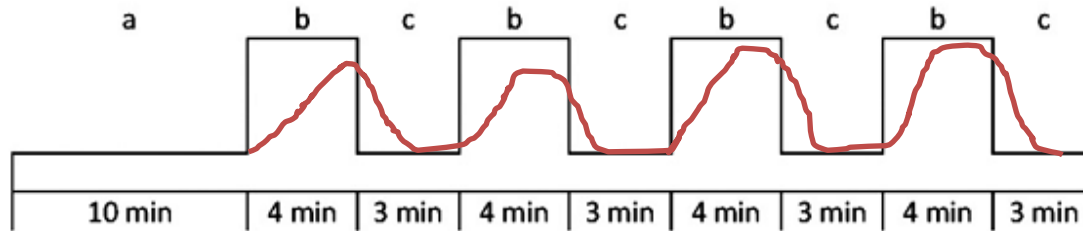


Time in zone



TE: treadmill exercise **GE:** usual care group exercise **HE:** home-based exercise

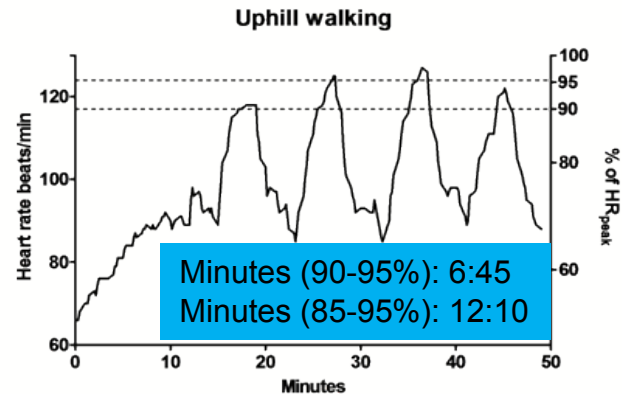
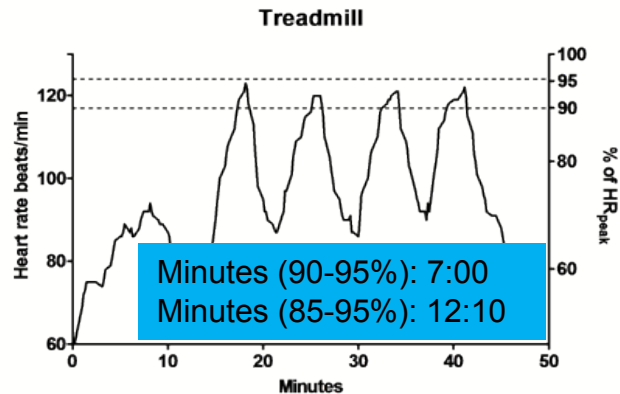
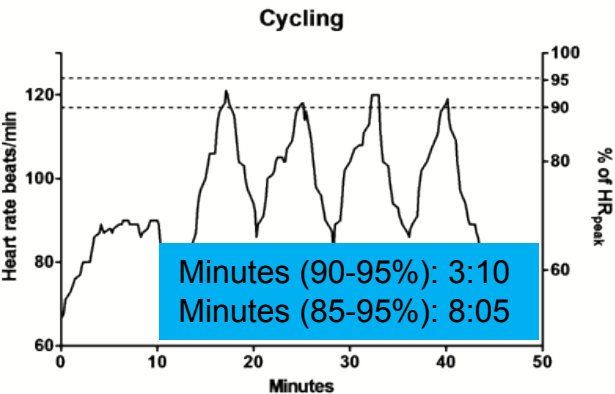
How to succeed?





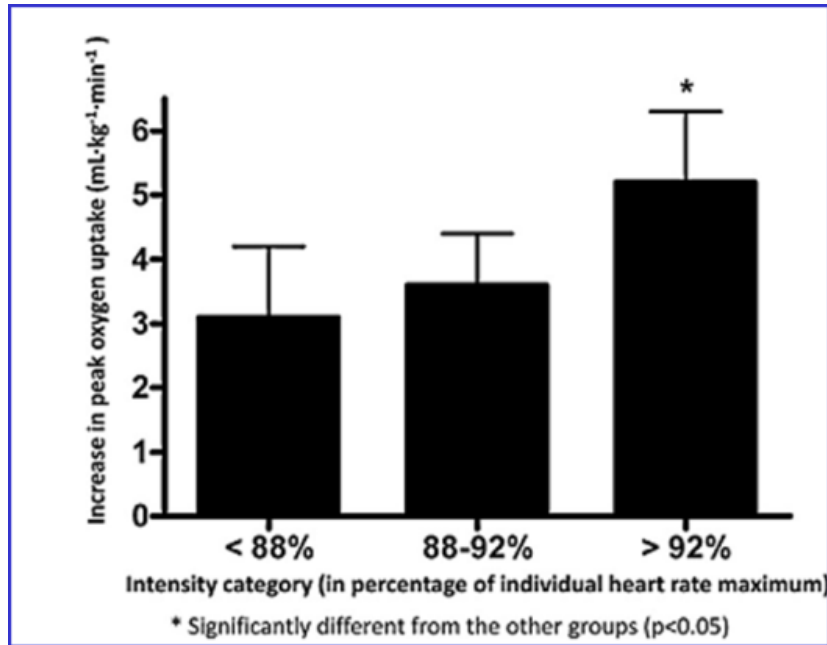
- Heart rate monitor
- 10-15 min warm up (brisk walk, jogging)
- First bout takes \approx 2 (3) min to reach target HR 90-95%
- 3 min followed by active recovery (e.g. walking down hill)
- Repeat 3 times
- Adjust work load
- Common challenge: too low/high work load

Does exercise mode matter?



Man 56 y, BMI 26, stable CAD
VO₂max 36 ml/kg/min
HR_{max} 130 bpm
Target heart rate 117-124 bpm (90-95%)

Does intensity matter?



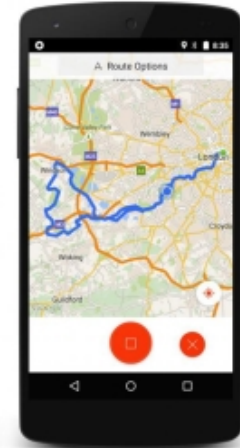
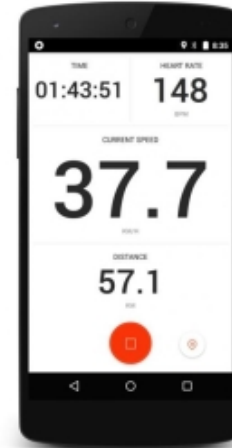
- 112 patients with CAD
- HIIT for 12 weeks
- Both supervised and unsupervised HIIT

Moholdt et al. JSAMS 2014

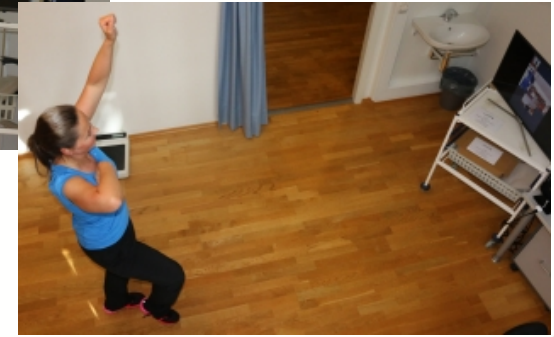
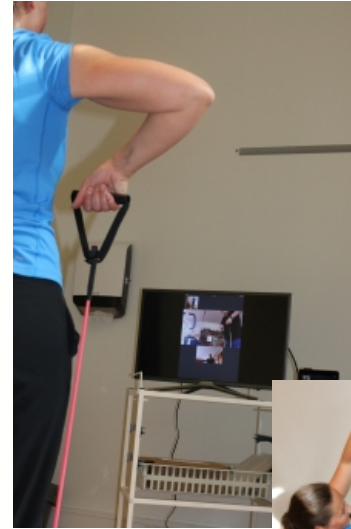
Supervised HIIT@home



- HR and intensity zones
- Goal achievement
- Online



Videoconference



PAI: Personal Activity Intelligence

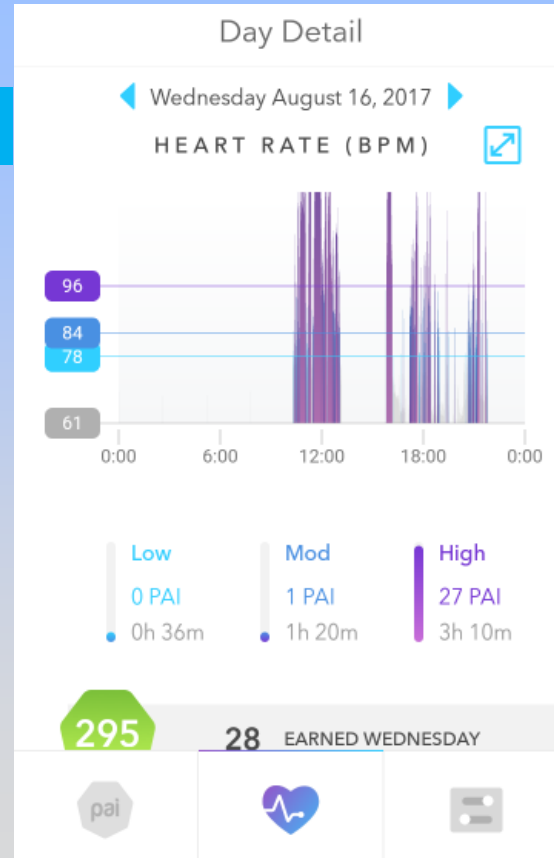
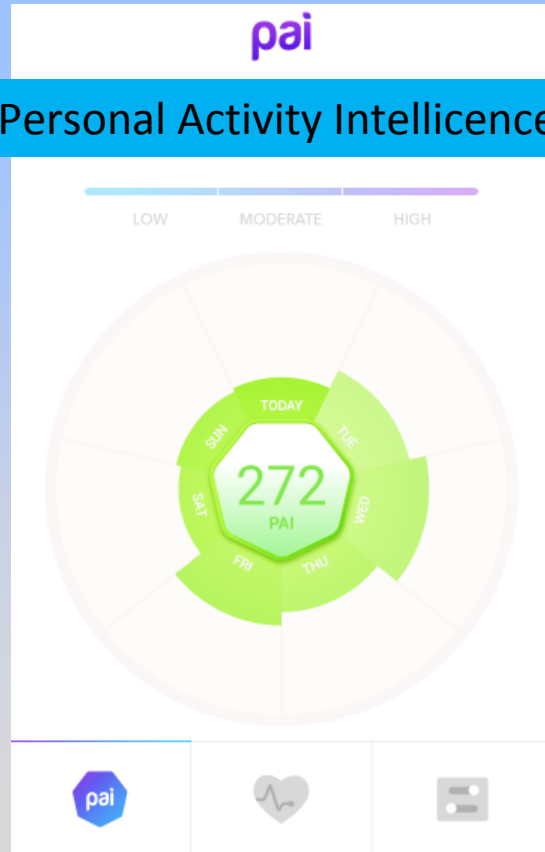


Table 1. The Number of Patients, Exercise-Hours, and the Corresponding Number of Cardiovascular Events Associated With Moderate- and High-Intensity Exercise, Respectively

Center	Patients, n	Total Training, h	Moderate Intensity, h	High Intensity, h
Ålesund	775	25 720 (1)	15 232	10 488 (1)
Feiring	2629	85 208 (2)	63 032 (1)	22 176 (1)
Røros	1442	64 892	51 192	13 700
Total	4846	175 820	129 456	46 364

Event rates

Cardiac arrest,
fatal

1

0

Cardiac arrest,
nonfatal

0

2

Myocardial
infarction

0

0

Risk of events

1/58 607

1/129 456

1/23 182

The numbers in parentheses indicate the number of events in each center according to intensity.

Rognmo et al. *Circulation*. 2012

Cardiopulmonary exercise test (CPET) strongly recommended

- Measures of VO₂ and energy expenditure
- Efficient and safe exercise intensity
- Prognosis
- Treatment evaluation

- **Safety under exercise**
 - Blood pressure response
 - Ahythmia
 - Ischemia

- Effect of exercise



Conraads & Becker, Heart 2010; Guazzi et al. Circulation 2012

Summary

- HIIT@home can be supervised, it is feasible and effective
- Instruction is crucial
- CPET recommended