# Grenzen stellen bij hartfalen patienten

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Sportarts

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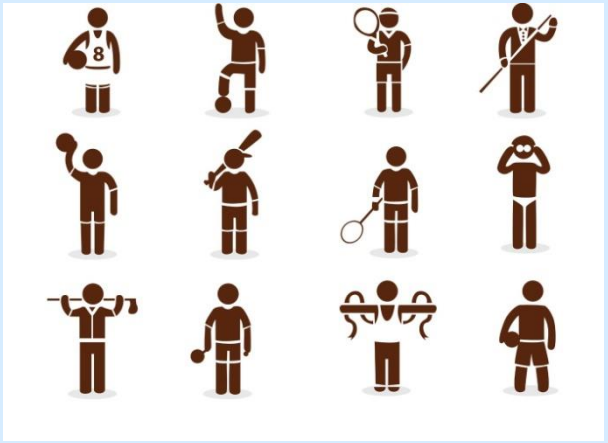
Bravis ziekenhuis

# CV

- 2000-2006 geneeskunde
- 2007-2011 sportgeneeskunde
- 2008-heden bondsarts KNKV
- 2011-heden sportarts Bravis
- 2015-heden sportarts Sportsclinic

# Sportarts

- 6 jaar geneeskunde: basis arts
- 4 jaar sportgeneeskunde: cardiologie, pulmonologie, orthopedie, huisartsgeneeskunde en sportgeneeskunde

- Sportgeneeskunde sinds jaren 65 (VSG)
- Eigen opleiding sinds halverwege de jaren 80
- Sociale geneeskunde
- 2014 erkenning tot medisch specialist en erkende opleiding
- 2016 basiszorg
- Sinds 2000 meer diversiteit en aandacht verlegd naar chronisch zieken

# Waarom sportarts bij chronische aandoeningen

Trainingsleer

Inspanningsfysiologie

chronische

aandoening

Winst!

- Nu nog algemeen specialisme, later mogelijk superspecialisme
  - Topsportgeneeskunde
  - Chronisch zieken sportgeneeskunde
  - Algemeen

- Keuringen (verplicht, eigen initiatief): aanvullende zorg
- Consulten: basis zorg (verwijzing)
  - Blessures
  - Inspanningsfysiologie (chronisch zieken, diagnostiek pathologie, adviezen)

# Inspanningsfysiologie

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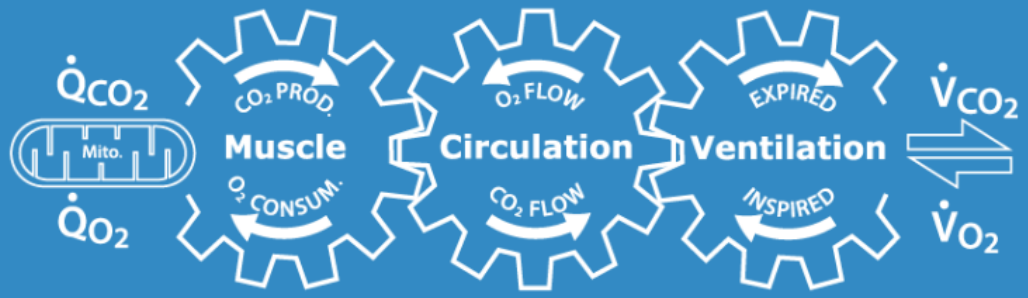
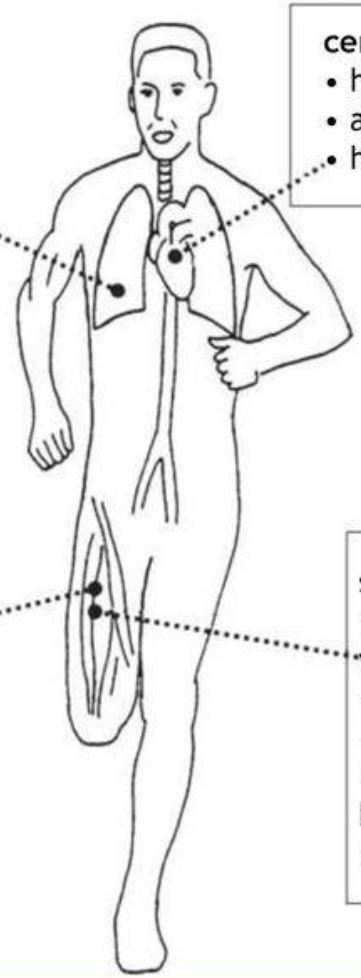


**respiratie**
- O2-diffusie
- ventilatie
- doderuimteventilatie
- alveolaire ventilatie: perfusieratio
- hemoglobine-O2-affiniteit

**centrale circulatie**
- hartminuutvolume
- arteriële bloeddruk
- hemoglobineconcentratie



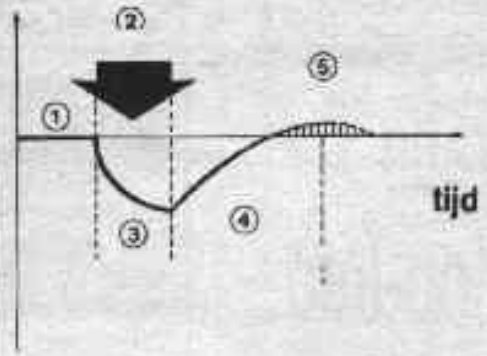
**perifere circulatie**
- bloedstroom naar niet-actieve regio's
- bloedstroom in spier
- capillaire dichtheid in de spier
- O2-diffusie
- O2-extractie
- hemoglobine-O2-affiniteit

**spiermetabolisme**
- enzymen en oxidatief vermogen
- energievoorraden
- myoglobine
- mitochondria - aantal en hoeveelheid
- substraatgebruik

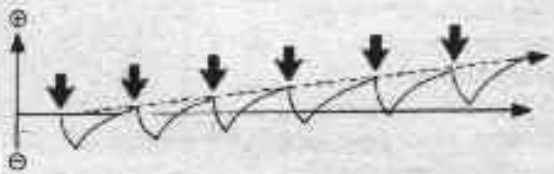
Takken, 2007

# Hartslagzones

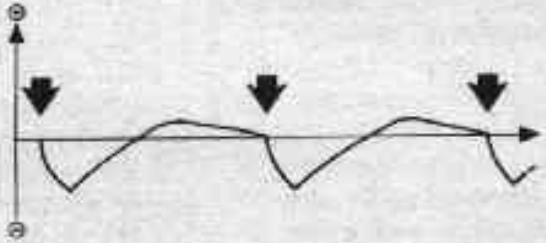
- Herstel: herstelhartslag
- D1: rustige duurtraining: doel opbouwen basis conditie (hersteltijd 24-48 uur)
- D2: intensieve duurtraining: doel ontwikkelen hogere snelheid die je lang vol kan houden (hersteltijd 48-72 uur)
- D3: Maximum Lactaat steady state: intervalvorm (hersteltijd 48-72 uur)
- Weerstand: boven de anaerobe drempel (hersteltijd 48 uur)



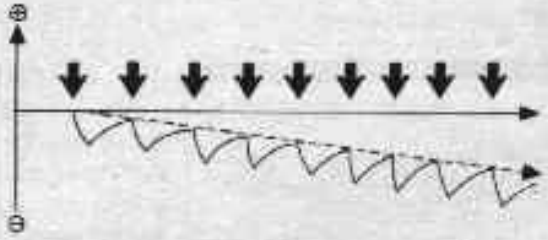

tek. 1: 1. beginniveau 2. trainingsprikkel 3. vermoeidheid 4. herstel 5. supercompensatie




tek. 2: Optimaal geplande trainingsprikkels

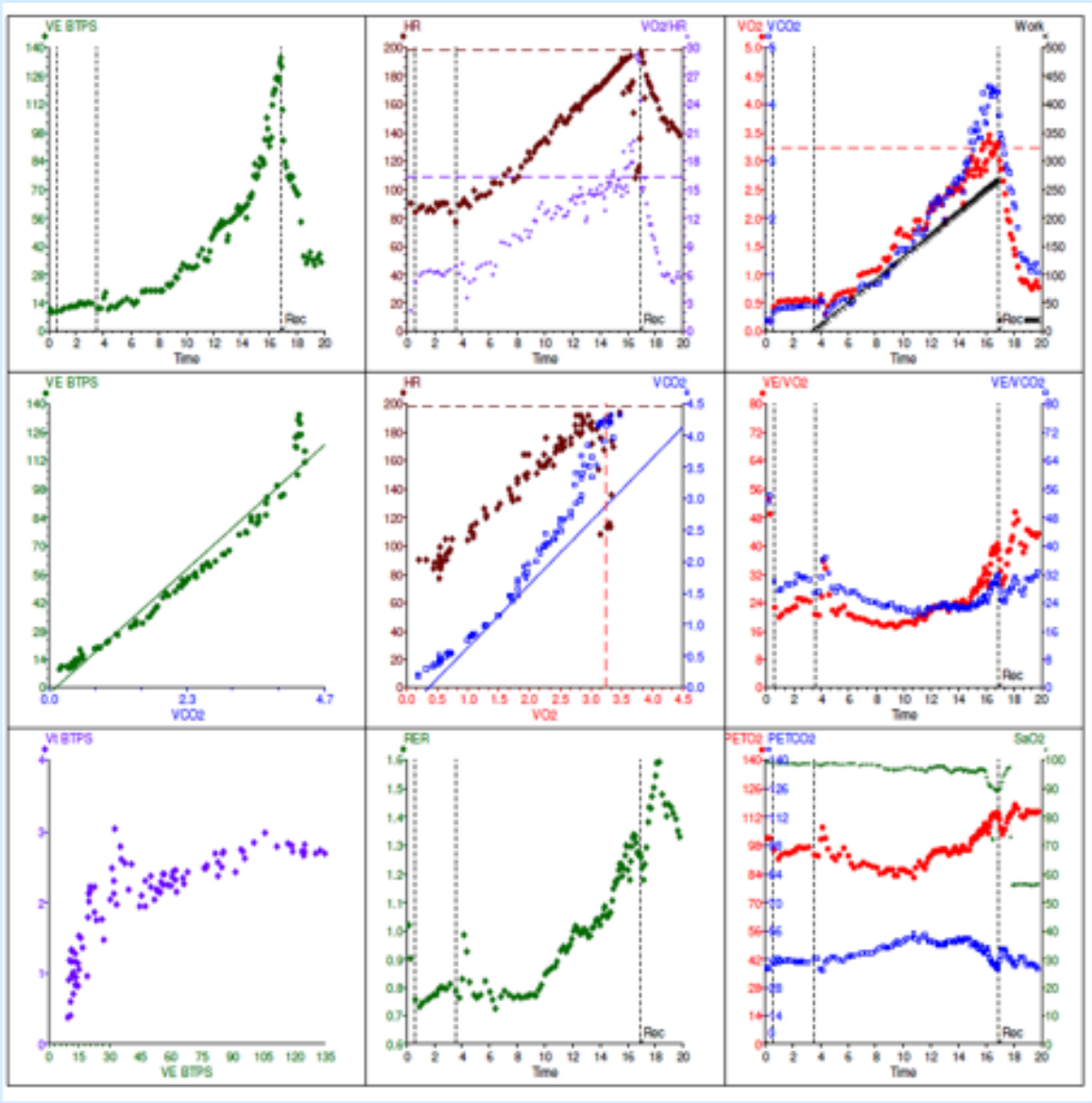



tek. 3: Stagnatie in de prestatieontwikkeling wegens te weinig training.

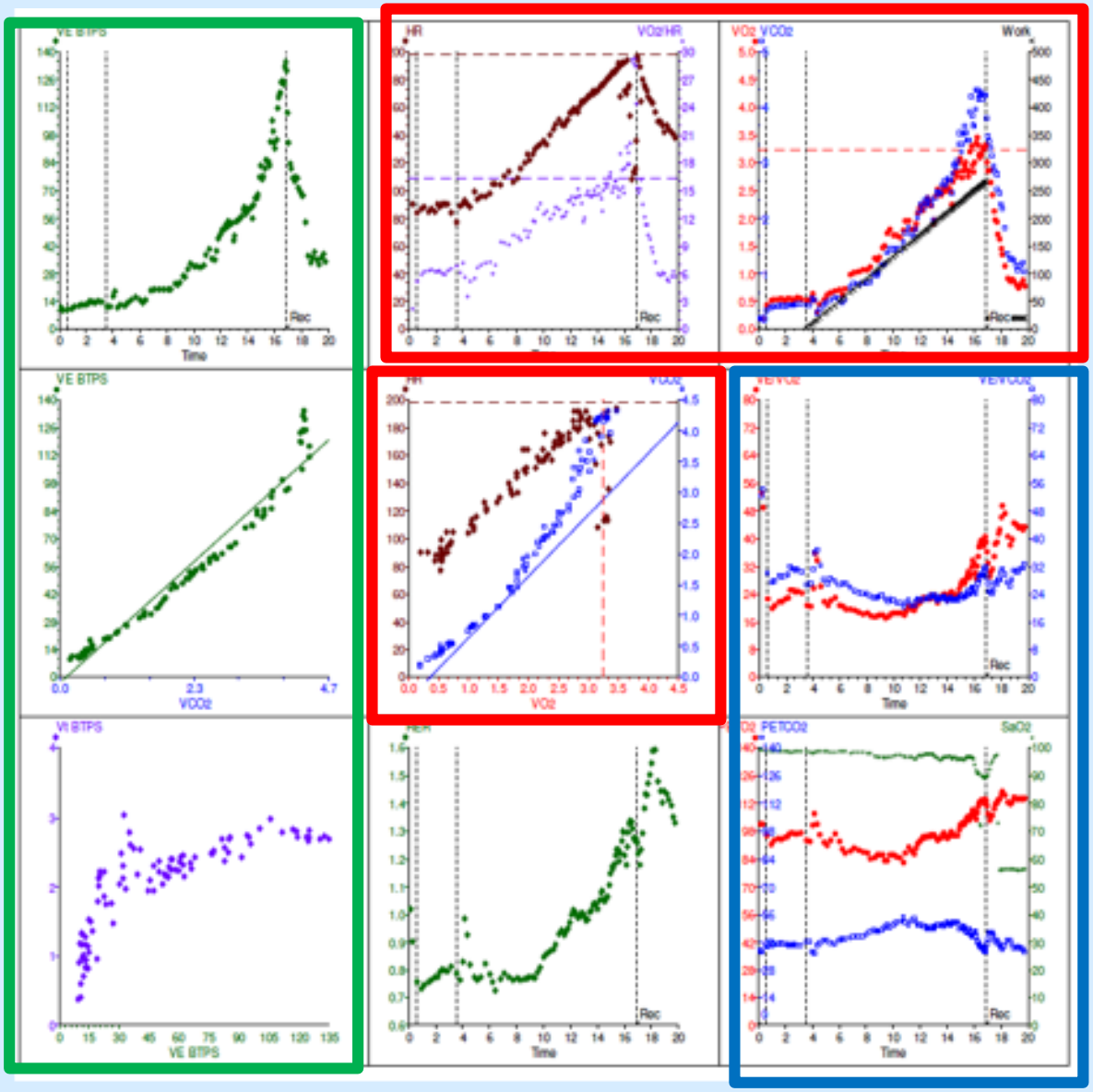



tek. 4: Prestatiedaling door onjuist geplande trainingen. De trainingsprikkels komen te vroeg, nog in de herstelfase.

# VO2 max testen



VE BTPS
Rec
Time
HR
VO2/HR
VO2 VCO2
Work
VCO2
VO2
VE/VO2
VE/VCO2
Vt BTPS
PER
PETO2 PETCO2
SaO2

- Multi-orgaan meting (cardiovasculair: 2,3 en 5, ademmechanica: 1,4 en 7, ventilatie/perfusie: 6 en 9)
- Uitkomst maten toepasbaar voor training op maat: bepalen omslagpunt (aeroob – anaeroob)

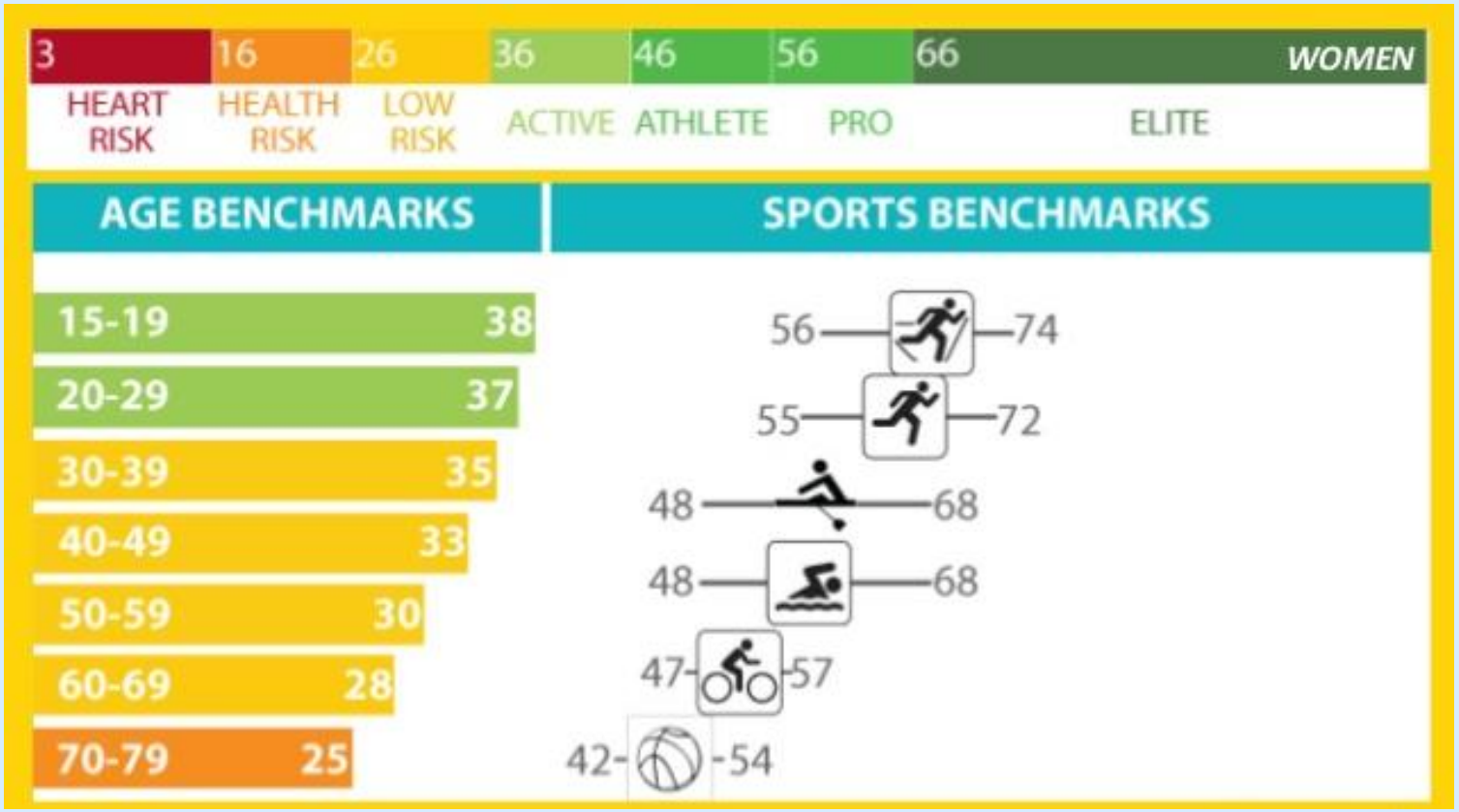

VE BTPS
Time
Rec
HR
VO2/HR
VO2 VCO2
Work
VE BTPS
VCO2
VO2
VR BTPS
VE BTPS
VEVO2
VEVCO2
O2 PETCO2
SaO2

# Waarom VO2?

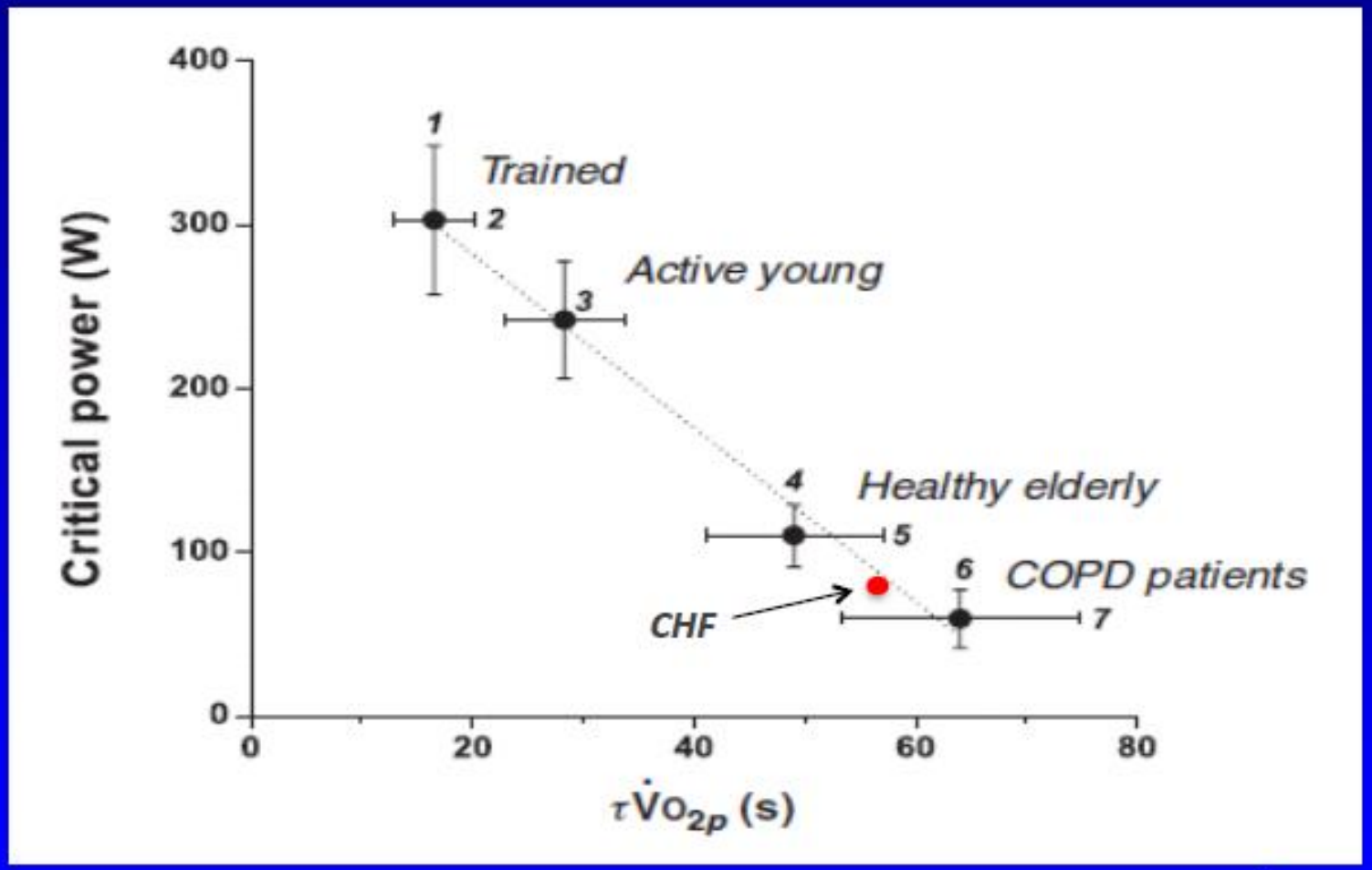
- I-ECG
- Pulmonale parameters
- Cardiale parameters

- Dus: “totaal” plaatje

# VO2 max waarden vrouwen



# Critical power vs. $\tau VO_2$ in health and disease



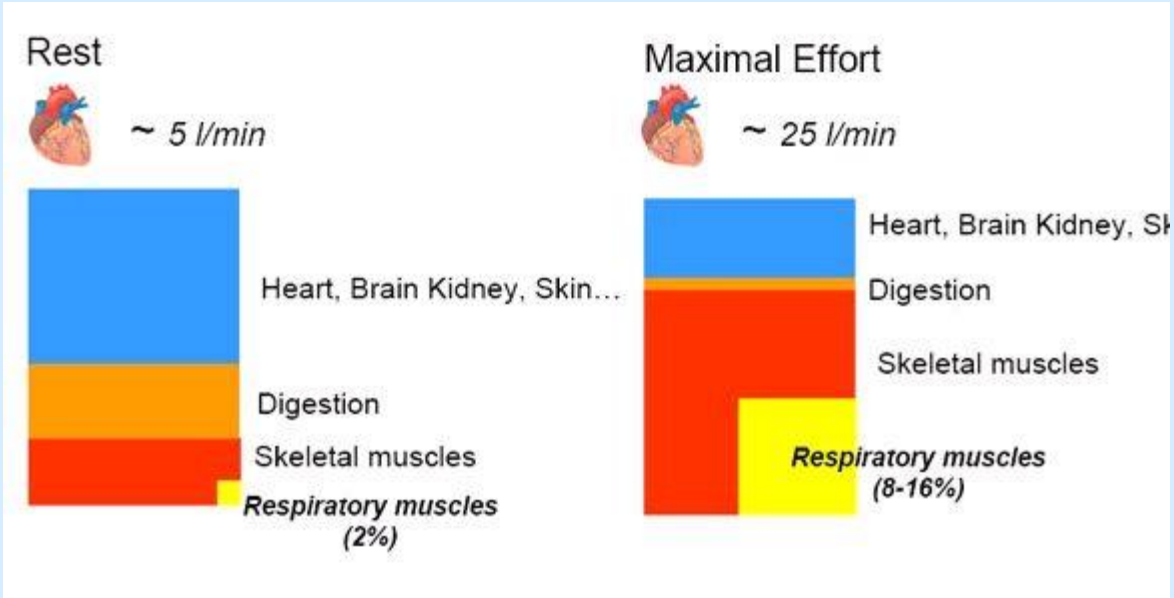

Rossiter HB, Compr Physiol 2011

# Hartfalen

- Vaak dyspnoe klachten (pulmonaal, cardiaal, ongetraindheid?)
- Van te voren (igv revalidatie) inspanningstest om:
  - Individuele inspanningstolerantie te leren kennen
  - (patho)fysiologische grenzen bepalen
  - “veiligheid” te waarborgen

# Doel trainen/revalidatie

- Vertrouwen in eigen lichaam/eigen kunnen
- Verbeteren conditie
- Verminderen morbiditeit/mortaliteit
- Afname kans nieuw event



# Starten met bewegen

- Tijdens hartrevalidatie (onder begeleiding)
- Actieve leefstijl (wandelen, fietsen)
- Norm gezond bewegen (30 min per dag)
- In een groepje/maatje

# Trainen onder begeleiding

- Maatwerk
- Afhankelijk van co-morbiditeit
- Aan de hand van VO2 max uitslagen/anaerobe drempel

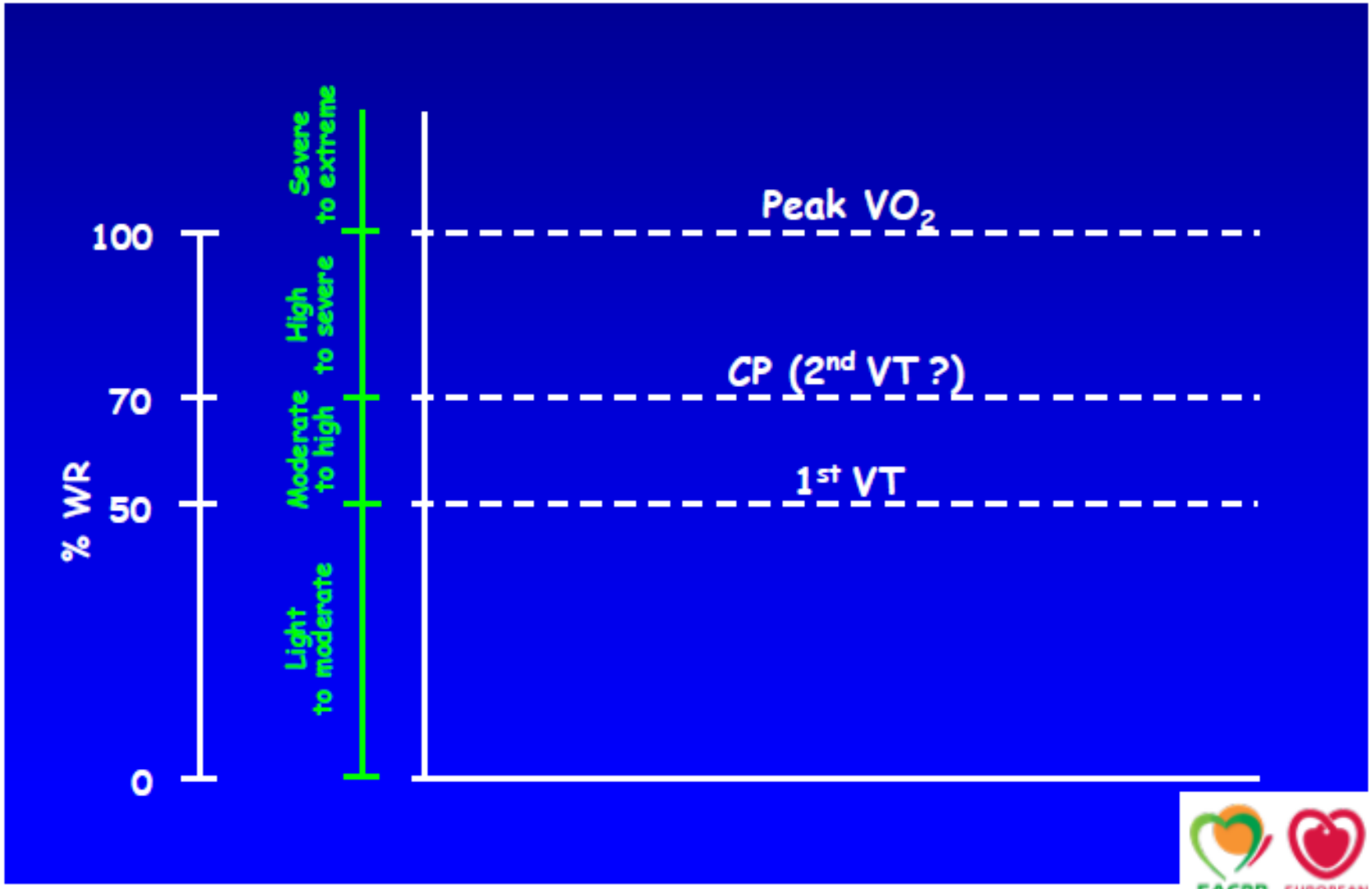
# Prescribable exercise intensities in cardiac patients

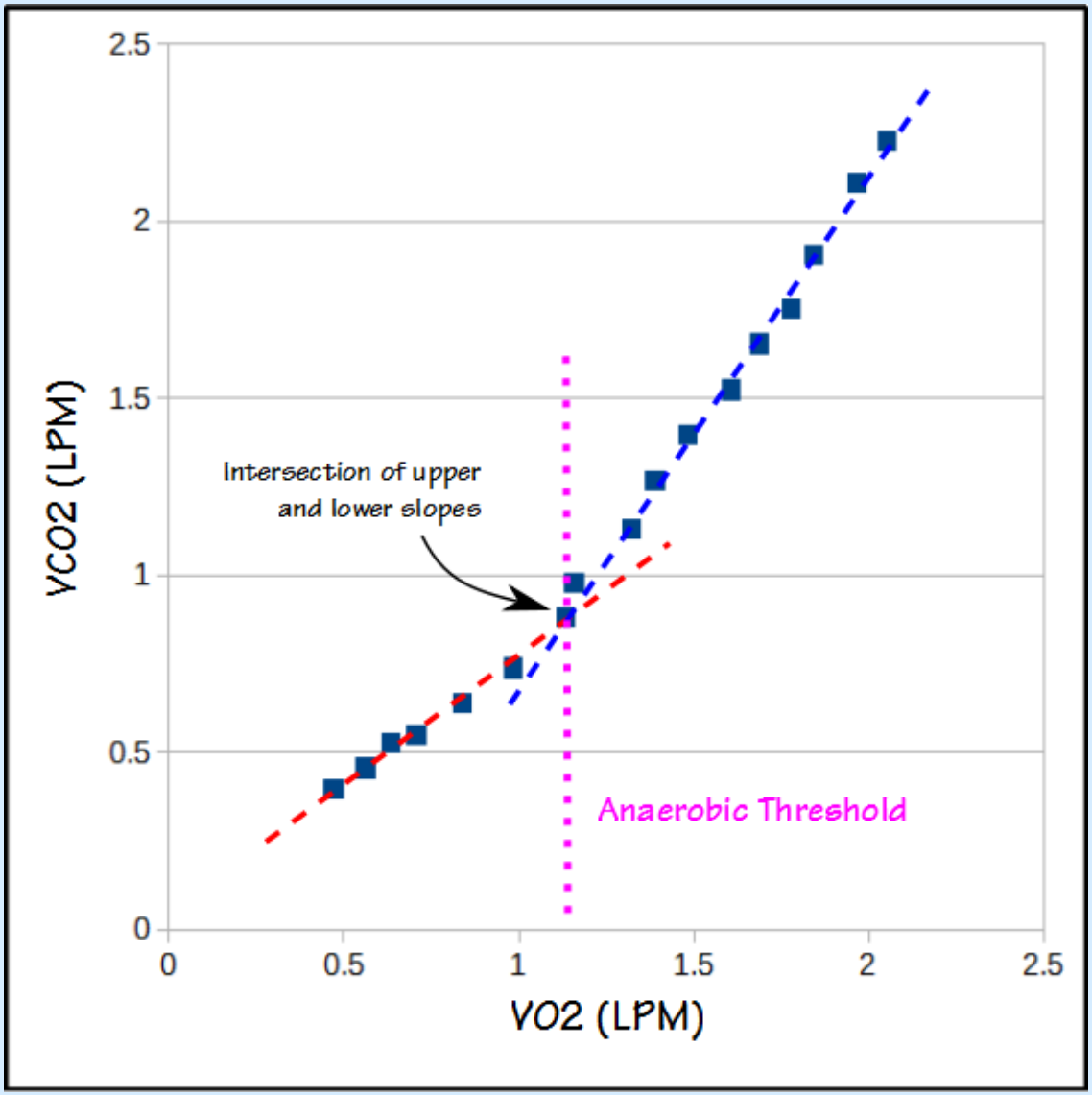
**Table 5.** Evidence-based prescribable aerobic exercise intensity in cardiac patient groups

| | Exercise intensity domains | | | |
|---|---|---|---|---|
| | Light to moderate | Moderate to high | High to severe | Severe to extreme |
| Stable angina pectoris | √[a] | √[a] | √[a] | |
| Chronic CAD (no residual ischaemia) | √ | √ | √ | √ |
| PCI | √ | √ | √ | |
| Pacemaker | √ | √ | | |
| ICD | √ | √ | | |
| Chronic AF | √[b] | √[b] | | |
| CABG | √ | √ | √ | |
| Valve repair/replacement | √ | √ | | |
| CHF | √ | √ | √ | |
| LVAD | √ | | | |
| Heart transplantation | √[c] | √[c] | √[c] | |

The grey areas identify intensity domains for which no scientific evidence is available in a specific population; CAD: coronary artery disease; PCI: percutaneous coronary intervention; ICD: implantable cardioverter defibrillator; AF: atrial fibrillation; CABG: coronary artery by-pass grafting; CHF: chronic heart failure; LVAD: left ventricular assist device; [a]Heart rate and/or work rate must in any case be lower than those corresponding to the ischaemic threshold; [b]Heart rate may not be usable due to highly variable chronotropic response; [c]Heart rate may not be usable due to denervation-related blunted chronotropic response.

# Exercise intensity domains




2.5
2
1.5
1
0.5
0
VCO2 (LPM)
Intersection of upper
and lower slopes
Anaerobic Threshold
0
0.5
1
1.5
2
2.5
VO2 (LPM)

# AT zonder test

- Anaerobe drempel: het moment waarop cellen (mitochondria) overschakelen van volledige (O2) verbranding van glucose naar onvolledige verbranding (CO2)

| | Doel | Gevoelsbeschrijving |
|---|---|---|
| **Zone 5** | Anaeroob vermogen en capaciteit | Zeer zware inspanning. Zoals bij heuveltraining, sprint en einde wedstrijd. |
| **Zone 4** | Snelheid, verhogen van de anaerobe drempel | Zware inspanning, net voor en rond omslagpunt. Geen behoefte aan praten, maar kan net, kortaf. |
| **Zone 3** | Uithoudingsvermogen | Middelmatige inspanning, verstevigde ademhaling. Praten kan met korte zinnen. |
| **Zone 2** | Vetverbranding | Makkelijk, ademhaling versnelt iets. |
| **Zone 1** | Herstel | Zeer lichte inspanning, makkelijk, lange gesprekken zijn onafgebroken mogelijk. |

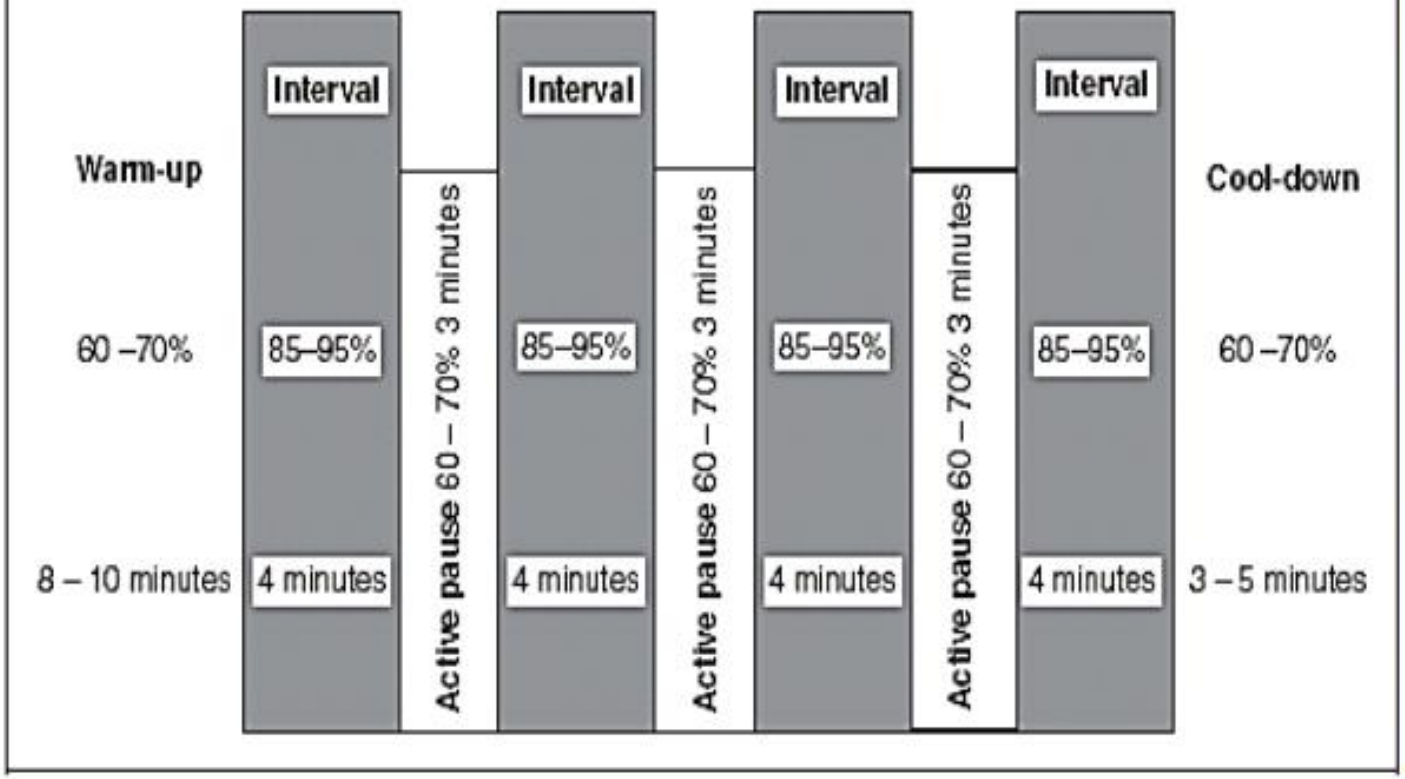
# Moderate to high-intensity domain

**Table I.** Physiological characteristics of the different intensity domains for constant-work-rate exercise

| | $VO_2$ steady-state | Lactate steady-state | Exercise duration | $VO_2$ vs. WR linear relationship | Training modality |
|---|---|---|---|---|---|
| Light to moderate | Yes | NA | >30 min | Yes | Continuous |
| Moderate to high | Yes | Yes | ~20–30 min | No | Continuous |
| High to severe | No | No | ~3–20 min | NA | Interval |
| Severe to extreme | No | No | ≤3 min | NA | Interval |

WR: work rate; NA: not applicable.

# High-intensity aerobic interval training



# High-intensity aerobic interval training in CHF

**TABLE 3. LV Volumes and Resting Hemodynamics**

| | Control | | MCT | | AIT | |
|---|---|---|---|---|---|---|
| | Baseline | Follow-Up | Baseline | Follow-Up | Baseline | Follow-Up |
| LVDD, mm | 67.2±8.1 | 67.8±12.5 | 69.1±8.6 | 68.2±6.5 | 66.7±6.8 | 59.0±6.8*† |
| LVSD, mm | 56.2±9.2 | 56.7±13.7 | 56.6±8.8 | 53.9±7.4 | 53.9±6.7 | 46.1±8.2*† |
| LVEDV, mL | 250.5±64.4 | 242.1±62.3 | 245.5±53.1 | 230.3±41.0 | 248.1±79.6 | 202.9±72.0*† |
| LVESV, mL | 187.8±53.0 | 186.6±58.6 | 172.9±48.7 | 160.6±34.3 | 177.4±72.1 | 133.9±57.8*† |
| HR at rest, bpm | 60±11 | 59±11 | 55±10 | 54±12 | 65±14 | 61±13 |
| SV, mL | 53.4±15.3 | 55.0±13.7 | 63.5±12.7 | 63.1±15.7 | 57.1±14.3 | 67.0±19.9* |
| CO, L/min | 3.1±0.6 | 3.2±0.5 | 3.5±0.9 | 3.4±1.1 | 3.5±0.5 | 3.9±0.6* |
| EF, % | 26.2±8.0 | 26.6±9.7 | 32.8±4.8 | 33.5±5.7 | 28.0±7.3 | 38.0±9.8*† |

Data are mean±SD. LVDD indicates LV diastolic diameter; LVSD, LV systolic diameter; LVEDV, LV end-diastolic volume; LVESV, LV end-systolic diameter; HR, heart rate; SV, stroke volume; CO, cardiac output; and EF, ejection fraction.

*Different from baseline, $P<0.01$; †different from controls and moderately trained, $P<0.02$.

**Wisløff U, Circulation 2007**

# Keuze criteria voor trainingsintensiteit

- Inspanning gerelateerd risico level (bijv VT's of ST depressie)
- Baseline conditie en gewoonten voor inspanning (inactief/actief)
- Kennis van inspanningstolerantie en (patho)fysiologische beperkingen (COPD)
- Indien voorhanden: wetenschappelijke evidence over trainingsprogramma's

# Sporten met een hartziekte

- Aanbeveling vanuit European Heart Journal 2005:
  - (Aangeboren hartafwijking)
  - (Klepafwijkingen)
  - Cardiomyopathie
  - Hypertensie
  - Ischemische hartziekte
  - Arrythmia en arrythmogene condities

Pelliccia A, et al. Recommendations for competitive sports participation in athletes with cardiovascular disease: a consensus document from the Study Group of Sports Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology. Eur Heart J. 2005 Jul;26(14):1422-45.

# Cardiomyopathie

| Lesion | Criteria for eligibility | Recommendations |
|---|---|---|
| Athletes with definite diagnosis of HCM | | No competitive sports |
| Athletes with definite diagnosis of HCM but low risk profile | No SD in the relatives, no symptoms, mild LVH, normal BP response to exercise, no ventricular arrhythmias | Low dynamic, low static sports (I |
| Athletes with only gene abnormalities of HCM, without phenotype changes | No symptoms, no LVH, no ventricular arrhythmias | Only recreational, non-competiti sport activities |
| Athletes with definite diagnosis of DCM | | No competitive sports |
| Athletes with definite diagnosis of DCM but low risk profile | No SD in the relatives, no symptoms, mildly depressed EF (≥40%), normal BP response to exercise, no complex ventricular arrhythmias | Low-moderate dynamic and low static sports (I A,B) |
| Athletes with definite diagnosis of ARVC | | No competitive sports |
| Athletes with active myocarditis or pericarditis | | No competitive sports |
| Athletes after resolution of myocarditis | No symptoms, normal LV function, no arrhythmias | All competitive sports |
| Athletes after resolution of pericarditis | No symptoms, normal LV function, no arrhythmias | All competitive sports |

**Table 1**

Classification of sports

| | A. Low dynamic | B. Moderate dynamic | C. High dynamic |
|---|---|---|---|
| I. Low static | Bowling Cricket Golf Riflery | Fencing Table tennis Tennis (doubles) Volleyball Baseball[a]/softball[a] | Badminton Race walking Running (marathon) Cross-country skiing (classic) Squash[a] |
| II. Moderate static | Auto racing[a,b] Diving[b] Equestrian[a,b] Motorcycling[a,b] Gymnastics[a] Karate/Judo[a] Sailing Archering | Field events (jumping) Figure skating[a] Lacrosse[a] Running (sprint) | Basketball[a] Biathlon Ice hockey[a] Field hockey[a] Rugby[a] Soccer[a] Cross-country skiing (skating) Running (mid/long) Swimming Tennis (single) Team handball[a] |
| III. High static | Bobsledding[a,b] Field events (throwing) Luge[a,b] Rock climbing[a,b] Waterskiing[a,b] Weight lifting[a] Windsurfing[a,b] | Body building[a] Downhill skiing[a,b] Wrestling[a] Snow boarding[a,b] | Boxing[a] Canoeing, Kayaking Cycling[a,b] Decathlon Rowing Speed skating Triathlon[a,b] |

*Adapted and modified after Mitchell et al.*[5]

[a]Danger of bodily collision.

[b]Increased risk if syncope occurs.

# Hypertensie

| Other risk factors and disease history | Clinic BP (mmHg) | | |
|---|---|---|---|
| | **Grade 1: SBP 140–159 or DBP 90–99** | **Grade 2: SBP 160–179 or DBP 100–109** | **Grade 3: SBP ≥180 or DBP ≥110** |
| No other risk factors[a] | Low added risk | Moderate added risk | High added risk |
| One or two risk factors[a] | Moderate added risk | Moderate added risk | Very high added risk |
| Three or more risk factors[a] or TOD[b] or diabetes | High added risk | High added risk | Very high added risk |
| Associated clinical conditions[c] | Very high added risk | Very high added risk | Very high added risk |

# Risicofactoren bij hypertensie

- Leeftijd (mannen >55, vrouwen >65)
- Roken
- Dyslipidemie
- Familie anamnese (cardiovasculair 1 graad bij mannen <55 en vrouwen <65)
- Buikomvang (mannen >102cm, vrouwen>88cm)
- TOD: LVH, micro albuminurie, atheroscelotische plaque

**Table 7**

Recommendations for competitive sport participation in athletes with systemic hypertension (and other risk factors) according to the CV risk profile

| Lesion | Evaluation | Criteria for eligibility | Recommendations | Follow-up |
|---|---|---|---|---|
| Low added risk | History, PE, ECG, ET, Echo | Well controlled BP | All sports | Yearly |
| Moderate added risk | History, PE, ECG, ET, Echo | Well controlled BP and risk factors | All sports, with exclusion of high static, high dynamic sports (IIIC) | Yearly |
| High added risk | History, PE, ECG, ET, Echo | Well controlled BP and risk factors | All sports, with exclusion of high static sports (III A–C) | Yearly |
| Very high added risk | History, PE, ECG, ET, Echo | Well controlled BP and risk factors, no associated clinical conditions | Only low-moderate dynamic, low static sports (I A–B) | 6 months |

**Table 1**

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*Adapted and modified after Mitchell et al.*[5]

[a]Danger of bodily collision.

[b]Increased risk if syncope occurs.

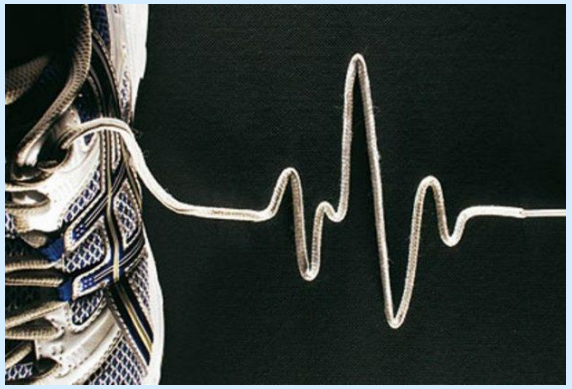
# Ischemische hartziekte

| | | | | |
|---|---|---|---|---|
| Athletes with definite diagnosis of IHD and high probability of cardiac events | History, ECG, ET, Echo, coronary-angiography | | No competitive sports allowed | |
| Athletes with definite diagnosis of IHD and low probability of cardiac events | History, ECG, ET, Echo, coronary-angiography | No exercise induced ischaemia, no symptoms or major arrhythmias, not significant (<50%) coronary lesions, EF >50% | Only low-moderate dynamic and low static sports (I A,B) | Yearly |
| Athletes without evidence of IHD but with high risk profile (>5% global SCORE) | History, ECG, ET | If positive provocative ECGs, further testing are needed (stress echo, scintigraphy, and/or coronary angiography) to confirm IHD. If positive, consider as athletes with diagnosis of IHD | Only low-moderate dynamic and low static sports (I A,B) | Yearly |
| | | If negative provocative ECGs | Individual based decision; avoid high static sports (IIIA–C) | Yearly |

# Arrythmia

- Sinusbradycardie (<40) en/of pauzes 2-3 sec *met* symptomen
  - Tijdelijke sportonderbreking bij symptomen, geen restricties zonder symptomen
- SVT: geen beperking
- AVNRT: geen beperking
- WPW (na ablatie): geen beperking
- Permanent AF: geen beperkingen, wel indivduele adviezen

- Nonsustained VT of slow VT: ip geen beperking, maar wel afhankelijk van onderliggende oorzaak
- Flauwvallen: afhankelijk van oorzaak
- Lang QT: geen competitieve sport
- Brugada: geen competieve sport



- Pacemaker: Mits normale LV functie en normale Hf respons bij inspanning
  - I A,B behalve sporten met risico op “bodily collision”
- ICD: mits geen maligne VT, normale LV functie, minimaal 6 maanden na implantatie en/of laatste interventie
  - I A,B behalve sporten met risico op “bodily collision”

**Table 1**

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*Adapted and modified after Mitchell et al.*[5]

[a]Danger of bodily collision.

[b]Increased risk if syncope occurs.

# Take home messages

- Bewegen is belangrijk
- Maatwerk voor hartfalen met comorbiditeit
- Competitiesporten binnen beperkte grenzen