Bewegen bij coronairlijden
een evidence based approach

T. Pustjens

Table 1 *Continued*

Components
• For secondary prevention in very-high-risk patients (i.e. documented ASCVD, either clinical or unequivocal on imaging), an LDL-C reduction of ≥50% from baseline and an LDL-C goal of <1.4 mmol/L (<55 mg/dL) are recommended
• For patients with ASCVD who experience a second vascular event within 2two years (not necessarily of the same type as the first event) while taking maximally tolerated statin therapy, an LDL-C goal of <1.0 mmol/L (<40 mg/dL) may be considered
• No goal for triglycerides, but <1.7 mmol/L (<150 mg/dL) indicates lower risk and higher levels indicate a need to look for other risk factors
Blood pressure management
• Assessment: BP frequently at rest. During exercise BP should be monitored when hypertension on effort is suspected. A SBP up to 200 mmHg at 100 W during exercise is advised as acceptable upper limit[25]
• Intervention:
• Offer lifestyle intervention in high-normal BP and grade 1–2–3 hypertension
• Consider drug treatment in high normal BP, in very high risk patients with CVD
• Drug treatment in grade 1–2–3 hypertension
Expected outcomes:
• BP <140/ 90 mmHg in all patients (targeted to 130/80 mmHg or lower in most patients when treatment is well tolerated)
• SBP in the range 120–129 mmHg in most <65 years patients receiving BP-lowering drugs
• SBP targeted to a range of 130–139 mmHg in older patients (aged ≥65 years) receiving BP-lowering drugs, with close monitoring of adverse effects
• DBP target of <80 mmHg for all hypertensive patients, independent of the level of risk and comorbidities.
Smoking cessation
• All smokers should be professionally encouraged to permanently stop smoking all forms of tobacco. Follow-up, referral to special multidisciplinary programmes and/or pharmacotherapy (including nicotine replacement) are recommended, as a stepwise strategy for smoking cessation. Structured approaches are to be used, for example, 5As: Ask, Advise, Assess, Assist, Arrange
• Ask the patient about his/her smoking status and use of other tobacco products. Specify both amount of smoking (cigarettes per day) and duration of smoking (number of years)
• Determine readiness to change; if ready, choose a date for quitting
• Assess for PSRFs that may impede success
• Intervention: provide structured follow-up. Offer behavioural advice and group or individual counselling
• Offer nicotine replacement therapy and/or bupropion, varenicline
• Smokers who quit smoking during hospitalization should be strongly supported to stay smoke free using the above steps in smoking cessation
• Patients trying to quit smoking should be helped in maintaining weight during this period, since are more likely to put on between 3 and 5 kg in the first three months to a year
• Offer assistance to avoid passive smoking
• No role of e-cigarettes for smoking cessation (unclear evidence about whether e-cigarettes or other Electronic Nicotine Delivery Systems are useful and safe[26])
Expected outcome:
Long-term abstinence from smoking
Psychosocial management
• Assessment for PSRFs: low socio-economic status, lack of social support, stress at work and in family life, posttraumatic stress, hostility, social isolation, cognitive impairment, depression, anxiety and other mental disorders.
• Adoption of a two-step evaluation of PSRFs in CR: first, to ask the patient single-item questions about distinct PSRFs and then to apply standardized questionnaires (i.e. the HeartQoL for quality of life in patients with CHD across European language groups; or HADS for anxiety/depression)
• Intervention:
• Provide multimodal behavioural interventions, integrating health education, physical exercise and psychological therapy, for PSRFs and coping with illness
• Referral to psychiatrist for psychotherapy, medication or collaborative care should be considered in the case of clinically symptoms of depression, anxiety or hostility
• Whenever possible, induce spouses and other family members, domestic partners, and/or significant others in such sessions (to be applied to other lifestyle measures also). Teach and support self-help strategies and ability to obtain effective social support.
• Integrate systematically psychosocial management with sexual counselling when appropriate
• When appropriate, provide vocational reintegration/return to work strategies of patients after an acute cardiac event
Expected outcome:
Absence of clinically significant psychosocial problems and acquisition of stress management skills
Work resumption and/or resumption of meaningful daily activities

Table 1 *Continued*

Components
Evaluation of the programme results and establishment of structured follow-up
Expected outcome:
• Individual determination of success or failure for each area of intervention
• Establishment of new rehabilitative goals based on successful and unsuccessful areas of intervention
• Adequate transmission of information for continuing of care
• Quality assurance of intervention using systematic registration on individual level
Establishment of structured follow-up focused on rehabilitative goals and secondary prevention in the short and long term.

Table 2 Core components of cardiac rehabilitation post acute coronary syndrome and post primary percutaneous coronary intervention.

Components	Established/agreed issues	Class (level)	Issues requiring further evidence
Patient assessment	• Clinical history: review clinical course of ACS and comorbidities • Physical examination: inspect puncture site, search other vascular atherosclerotic localizations • Evaluation: clinical condition, medications, risk factors, psychological and social aspects, exercise capabilities	I (A)	
	• Peak exercise capacity evaluation before and after CR completion: symptom limited exercise stress testing by bicycle ergometry or treadmill stress test (CPET recommended if available)	I (A)	Utility and feasibility of CPET in all CR patients
	• Assess myocardial ischaemia and viability by means of stress echo, CMR, SPECT, or PET, if not performed during acute hospital stay	IIb (C)	
	• In patients with pre-discharge LVEF ≤40%, repeat echocardiography 6–12 weeks after MI, and after complete revascularization and optimal medical therapy, to assess the potential need for primary prevention ICD implantation and potential function recovery. Assess the risk of arrhythmias by Holter-24 and exercise test	I (C)	
Physical activity counselling	If not otherwise specified according to individual clinical pattern, recommend patients after the end of the CR programme to accumulate at least 30 min/day, 5 days/week of moderate intensity PA (i.e. 150 min/week) or 15 min/ day, 5 days/ week of vigorous intensity PA (75 min/week), or a combination of both, performed in sessions with a duration of at least 10 min. Shorter exercise sessions (i.e. <10 min) may also be appropriate, especially in very deconditioned individuals	I (A)	Safety of vigorous intensity and HIIT without supervision
Exercise training	The programme should include supervised medically prescribed aerobic exercise training: • Low-risk patients: see *Table 1*. • Moderate to high-risk patients because of left ventricular dysfunction, coronary disease severity, comorbidities, ageing; similar to low risk group but starting at 40% of the HRR • In case of asymptomatic ischemia consider 40–60% of heart rate reserve at the onset of ischaemia. Prophylactic nitroglycerine can be taken at the start of the training session in selected cases Resistance training to increase exercise capacity and muscle strength (see *Table 1*)	I (B)	• Modern definition of low and moderate-to-high risk patients • Utility and best protocols of aerobic HIIT
Lipid management	After ACS if the LDL-C goal is not achieved after 4–6 weeks despite maximal tolerated statin therapy and ezetimibe, addition of a PCSK9 inhibitor is recommended		

ACS: acute coronary syndrome; CMR: cardiac magnetic resonance; CPET: cardiopulmonary exercise testing; CR: cardiac rehabilitation; HIIT: high intensity interval training; HRR: heart rate reserve; ICD: implantable cardiac defibrillator; LDL-C: low-density lipoprotein cholesterol; LVEF: left ventricular ejection fraction; MI: myocardial infarction; PA: physical activity; PET: positron emission tomography; SPECT: single-photon emission computed tomography

Cardiac rehabilitation in coronary artery disease

- Exercise-based training
  - Moderate vs. high-intensity training
- Resistance training
  - Resistance training + aerobic exercise vs aerobic exercise
- ESC guideline recommendations
- Challenges in cardiac rehabilitation
- Cost-effectiveness

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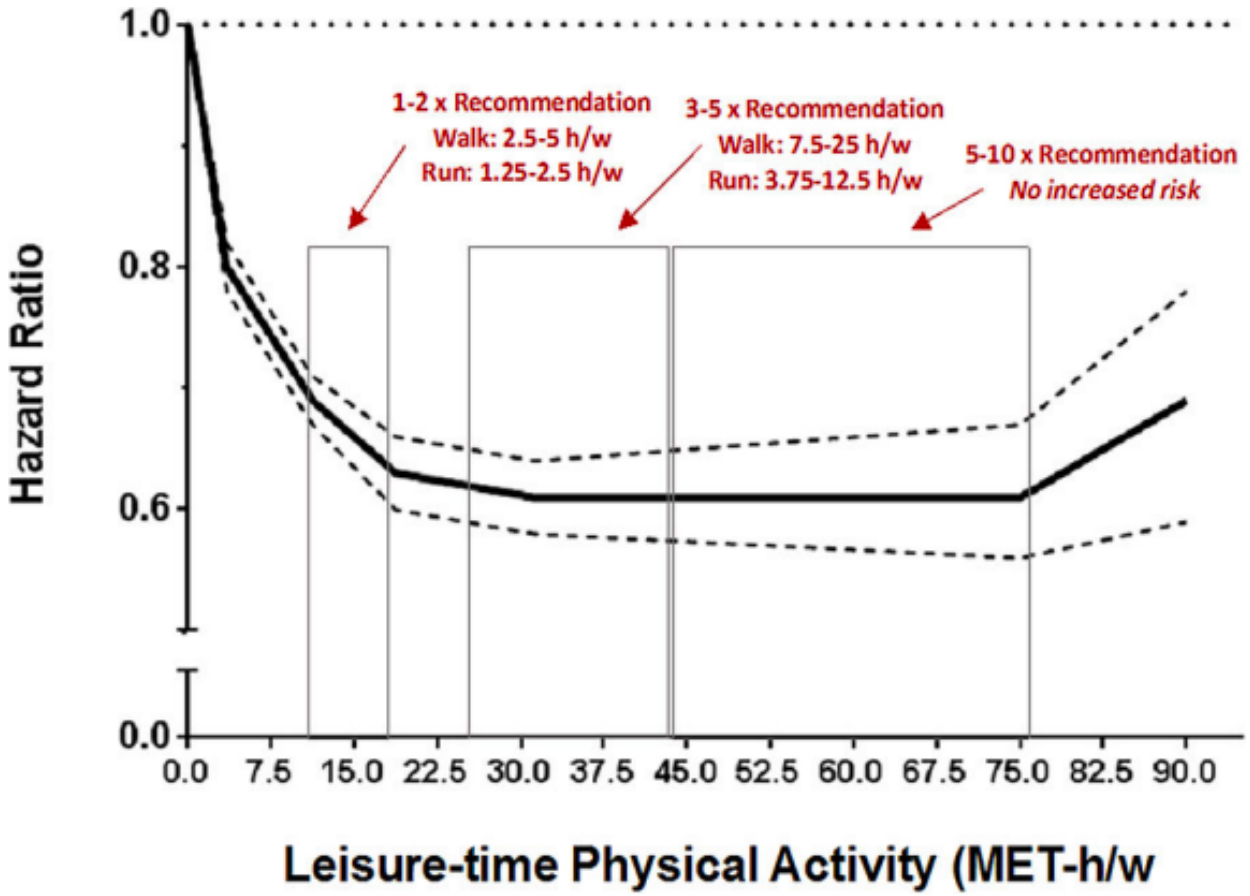
General physical activity



Conclusions

- Large reduction of all-cause mortality
- Modest amount of exercise is beneficial
- Large amount of exercise is not harmful

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Arem. JAMA Intern Med. 2015
Kraus. Med Sci Sports Exerc. 2019

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Gaesser.
BMJ – Christmas special. 2022

Exercise-based cardiac rehabilitation

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FITT PRINCIPLE

FREQUENCY

INTENSITY

TIME

TYPE

Exercise-based cardiac rehabilitation for coronary heart disease (Review)

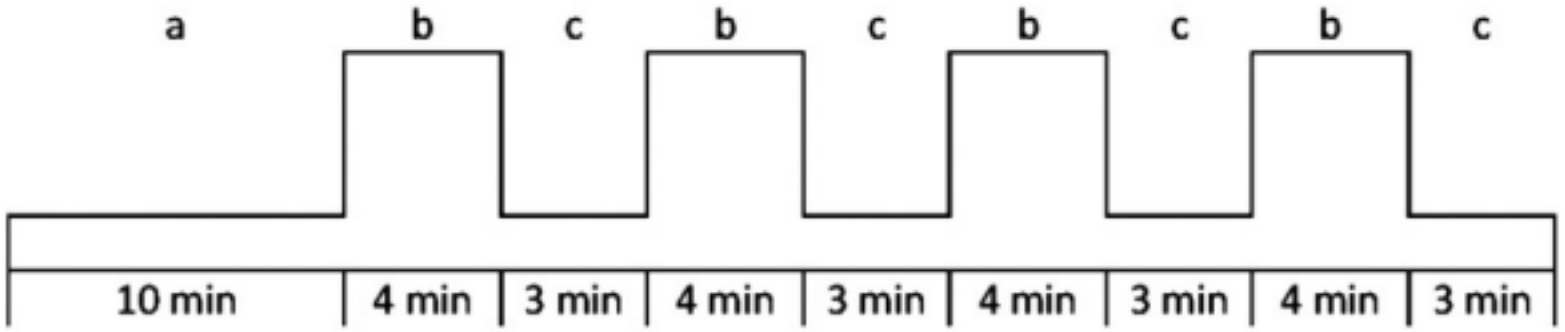
Dibben G, Faulkner J, Oldridge N, Rees K, Thompson DR, Zwisler AD, Taylor RS

- Cochrane review (2021)
  - 85 RCTs of exercise based interventions compared with ‘no exercise’
  - Almost 25,000 patients with coronary heart disease

- Short-term FUP (6-12months)
  - All-cause mortality RR 0.87 [0.73-1.04]
  - Myocardial infarction RR 0.72 [0.55-0.93]
  - All-cause hospitalization RR 0.58 [0.43-0.77]
  - No difference in cardiovascular mortality, and revascularization procedures
- Medium-term FUP (12-36months)
  - Cardiovascular mortality RR 0.77 [0.63-0.93]
- Long-term FUP (>36 months)
  - Cardiovascular mortality RR 0.58 [0.43-0.78]
  - Myocardial infarction RR 0.67 [0.50-0.90]
- Improvement in QoL

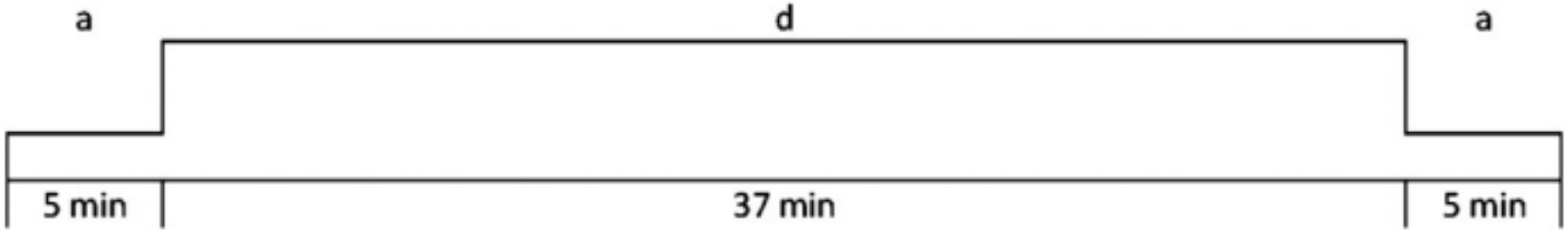
Moderate vs. high-intensity training (HIT)

A. AIT programme (38 min)



(ACT)

B. ACT programme (47 min)



diovascular

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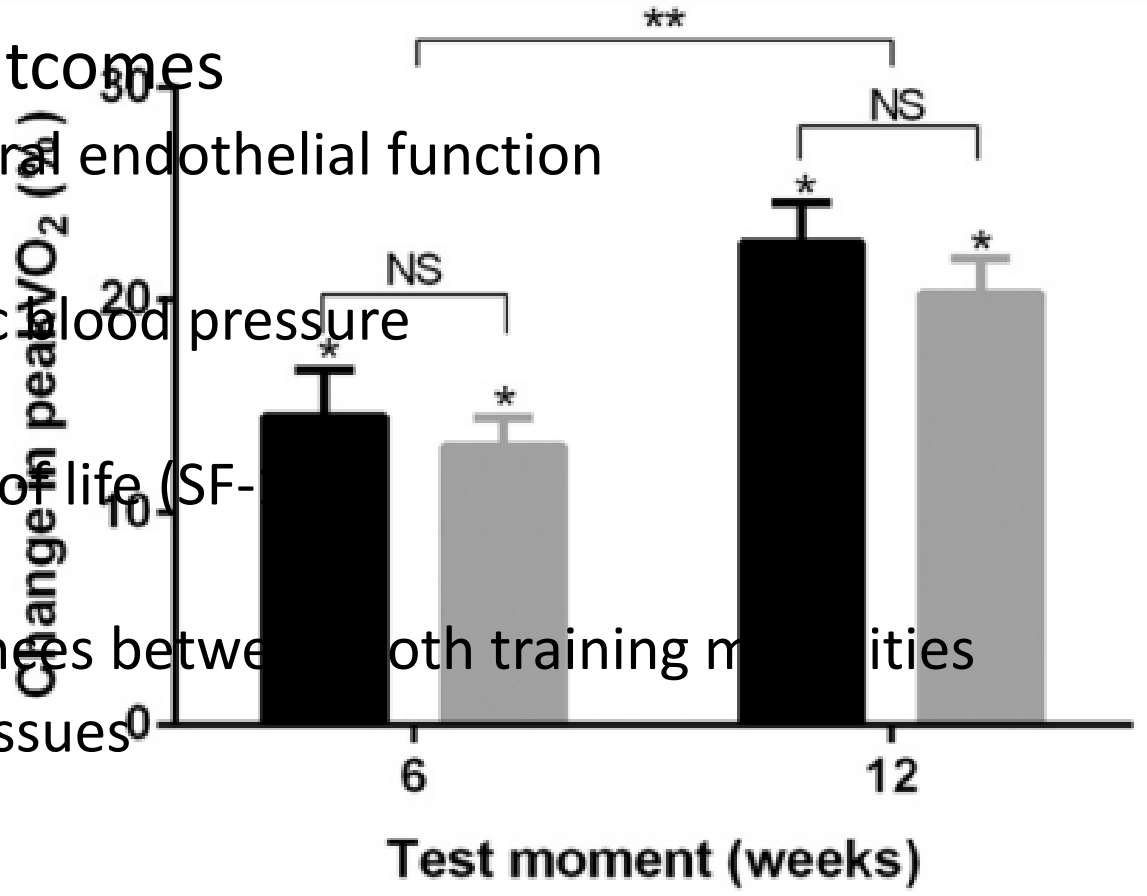
Conraads. IJC. (2015).

SAINTEX-CAD study

- Seconday outcomes
  - ▲ peripheral endothelial function
  - ▲ HDL
  - ▼ diastolic blood pressure
  - ▼ hsCRP
  - ▲ Quality of life (SF-
  - No differences betwe oth training m ities
  - No safety issues



= AIT = ACT

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Conraads. IJC. (2015).

Moderate vs. high-intensity training (HIT)

- HIT
  - Greater improvement in VO2 max
  - More time-efficient
  - Adherence after termination of CR?
  - Clinical relevance?

Key in exercise-based CR is the **total energy expenditure** rather than the specific training characteristic

Resistance training: does it matter?

- Low muscular strength is a risk factor for all-cause and cardiovascular death
- Resistance training is associated with lower mortality

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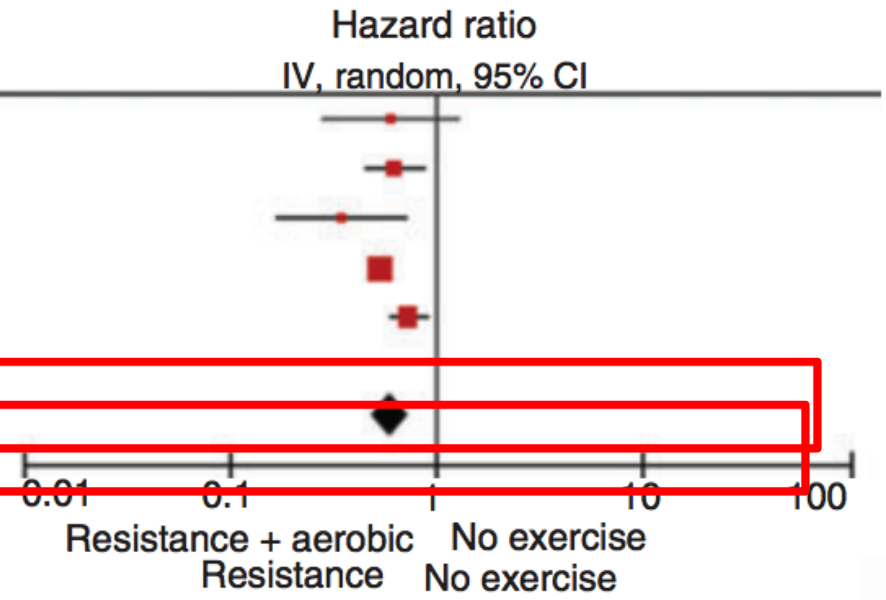
(d)

Study or subgroup	log[Hazard ratio]	SE	Weight	Hazard ratio IV, random, 95% CI
Courneya 2014	−0.5014	0.3864	5.6%	0.61 [0.28, 1.29]
Kamada 2017	−0.462	0.1605	20.2%	0.63 [0.46, 0.86]
Loprinzi 2015	−1.0498	0.3684	6.1%	0.35 [0.17, 0.72]
Schoenborn 2011-A	−0.6162	0.0601	37.9%	0.54 [0.48, 0.61]
Schoenborn 2011-B	−0.3147	0.1001	30.2%	0.73 [0.60, 0.89]
Total (95% CI)			100.0%	0.60 [0.49, 0.72]

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 8.83$, df = 4 ($P = 0.07$); $I^2 = 55\%$

Test for overall effect: Z = 5.26 ($P < 0.00001$)

Test for overall effect: Z = 3.31 ($P = 0.0009$)



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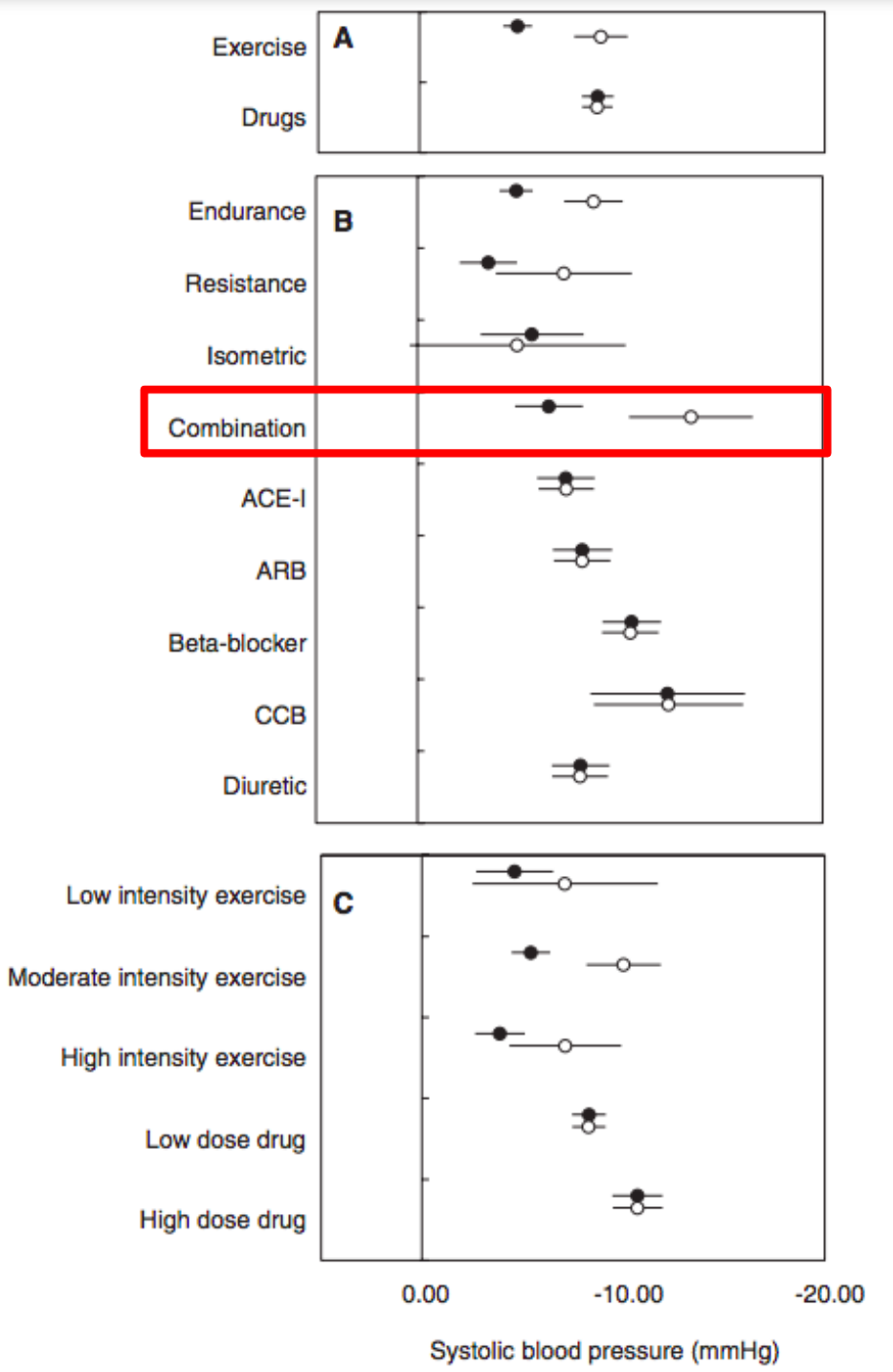
Saedifard. Eur J Prev. 2019

Resistance training: does it matter?



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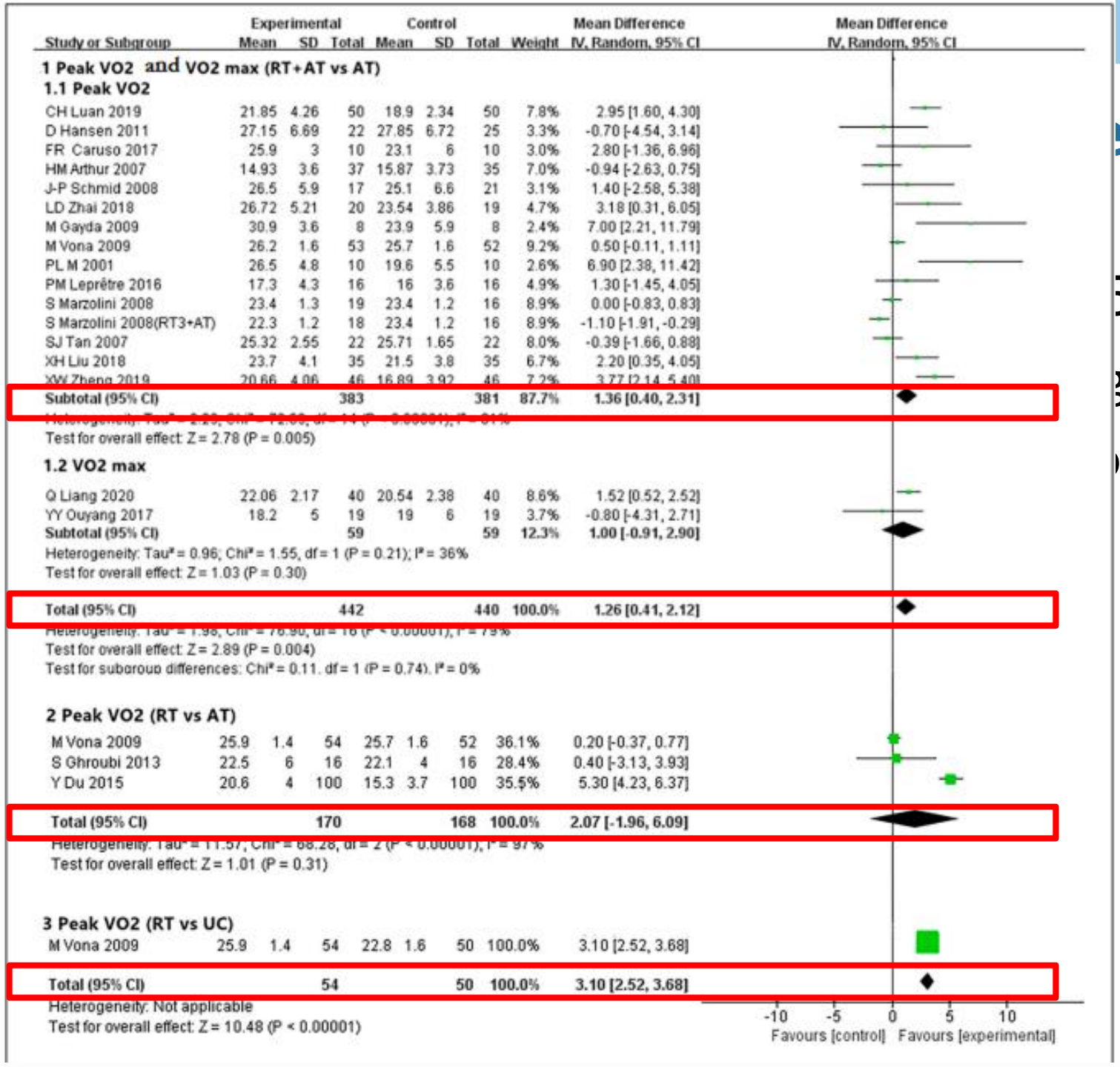
Naci. Br J Sports Med. 2019

Resistance training in coronary artery disease

- Resistance exercise; 2-3 times/week
  - Upper body: 8-10 repetitions of 30-70% of the 1 repetition maximum (1RM)
  - Lower body: 12-15 repetitions of 40-80% of 1RM



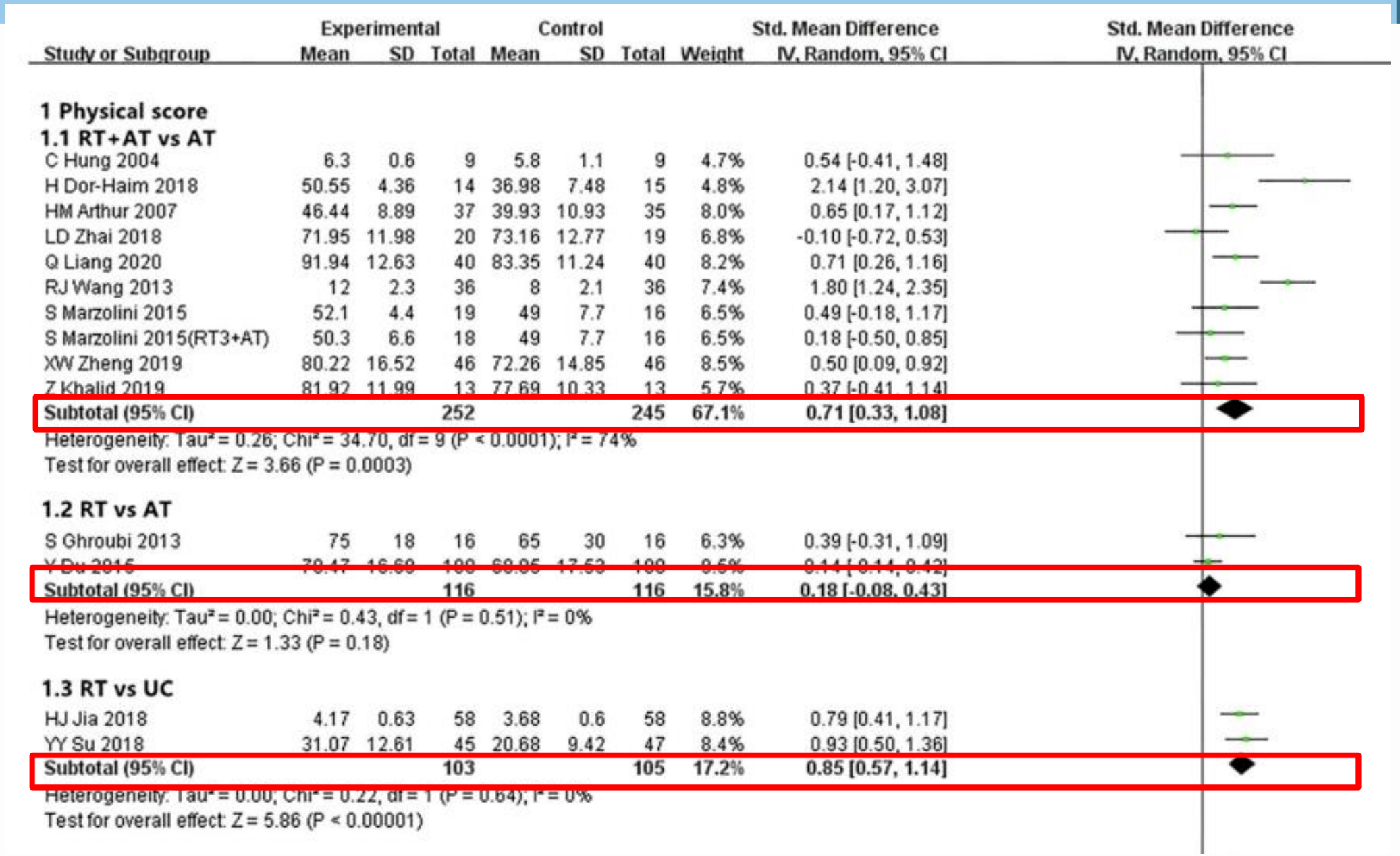
ery disease

5 patients)

g (AT) vs AT, and RT vs AT

f-Life

Fan. Front. Cardiovasc. Med. 2021



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1 Physical score								
1.1 RT+AT vs AT								
C Hung 2004	6.3	0.6	9	5.8	1.1	9	4.7%	0.54 [-0.41, 1.48]
H Dor-Haim 2018	50.55	4.36	14	36.98	7.48	15	4.8%	2.14 [1.20, 3.07]
HM Arthur 2007	46.44	8.89	37	39.93	10.93	35	8.0%	0.65 [0.17, 1.12]
LD Zhai 2018	71.95	11.98	20	73.16	12.77	19	6.8%	-0.10 [-0.72, 0.53]
Q Liang 2020	91.94	12.63	40	83.35	11.24	40	8.2%	0.71 [0.26, 1.16]
RJ Wang 2013	12	2.3	36	8	2.1	36	7.4%	1.80 [1.24, 2.35]
S Marzolini 2015	52.1	4.4	19	49	7.7	16	6.5%	0.49 [-0.18, 1.17]
S Marzolini 2015(RT3+AT)	50.3	6.6	18	49	7.7	16	6.5%	0.18 [-0.50, 0.85]
XW Zheng 2019	80.22	16.52	46	72.26	14.85	46	8.5%	0.50 [0.09, 0.92]
Z Khalid 2019	81.92	11.99	13	77.69	10.33	13	5.7%	0.37 [-0.41, 1.14]
Subtotal (95% CI)			**252**			**245**	**67.1%**	**0.71 [0.33, 1.08]**
Heterogeneity: Tau² = 0.26; Chi² = 34.70, df = 9 (P < 0.0001); I² = 74%								
Test for overall effect: Z = 3.66 (P = 0.0003)								
1.2 RT vs AT								
S Ghroubi 2013	75	18	16	65	30	16	6.3%	0.39 [-0.31, 1.09]
Y Du 2016	79.47	16.69	100	69.95	17.53	100	9.5%	0.54 [0.14, 0.42]
Subtotal (95% CI)			**116**			**116**	**15.8%**	**0.18 [-0.08, 0.43]**
Heterogeneity: Tau² = 0.00; Chi² = 0.43, df = 1 (P = 0.51); I² = 0%								
Test for overall effect: Z = 1.33 (P = 0.18)								
1.3 RT vs UC								
HJ Jia 2018	4.17	0.63	58	3.68	0.6	58	8.8%	0.79 [0.41, 1.17]
YY Su 2018	31.07	12.61	45	20.68	9.42	47	8.4%	0.93 [0.50, 1.36]
Subtotal (95% CI)			**103**			**105**	**17.2%**	**0.85 [0.57, 1.14]**
Heterogeneity: Tau² = 0.00; Chi² = 0.22, df = 1 (P = 0.64); I² = 0%								
Test for overall effect: Z = 5.86 (P < 0.00001)								

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Summary

- Cardiac rehabilitation
  - ▼ Reduction in all-cause and cardiovascular mortality
  - ▼ Reduction in recurrent hospital admissions
  - ▲ Improves exercise capacity
  - ▲ Improves quality-of-life
- Exercise-based CR
  - **Key** is the **total energy expenditure** and not the type of exercise
- Resistance training
  - ▼ Reduces all-cause mortality
  - ▼ Reduces systolic blood pressure
  - ▲ Improvement of VO2 and QoL in CR

ESC guideline recommendations

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Cardiac rehabilitation in coronary heart disease

Indications CR referral

- Acute coronary syndromes
- Undergoing reperfusion
- Chronic coronary syndromes

Key components of CR

- Screening cardiovascular risk factors
- Physical activity counselling
- Exercise training
- Diet/nutritional counselling
- Risk factor control
  - LDL < 1.4mmol/L
  - BMI 18.5-25kg/m2
  - Blood pressure < 140/90mmHg
- Patient education
- Psychosocial management

Physical activity

4.3.1. Physical activity and exercise

Recommendations for physical activity

Recommendations	Class[a]	Level[b]
It is recommended for adults of all ages to strive for at least 150 - 300 min a week of moderate-intensity or 75 - 150 min a week of vigorous-intensity aerobic PA, or an equivalent combination thereof, to reduce all-cause mortality, CV mortality, and morbidity.[371,372]	I	A
It is recommended that adults who cannot perform 150 min of moderate-intensity PA a week should stay as active as their abilities and health condition allow.[373,374]	I	B
It is recommended to reduce sedentary time to engage in at least light activity throughout the day to reduce all-cause and CV mortality and morbidity.[375–377]	I	B
Performing resistance exercise, in addition to aerobic activity, is recommended on 2 or more days per week to reduce all-cause mortality.[378,379]	I	B

Visseren. Eur Heart J (2021).

Cardiac rehabilitation

Recommendations for cardiac rehabilitation

Recommendations	Class[a]	Level[b]
Participation in a medically supervised, structured, comprehensive, multidisciplinary EBCR and prevention programme for patients after ASCVD events and/or revascularization, and for patients with HF (mainly HFrEF), is recommended to improve patient outcomes.[638–642]	I	A
Methods to increase CR and prevention referral and uptake should be considered (i.e. electronic prompts or automatic referrals, referral and liaison visits, structured follow-up by nurses or health professionals, and early programme initiation after discharge).[643–646]	IIa	B
Home-based CR, telehealth, and mHealth interventions may be considered to increase patient participation and long-term adherence to healthy behaviours.[647,648]	IIb	B

Visseren. Eur Heart J (2021).

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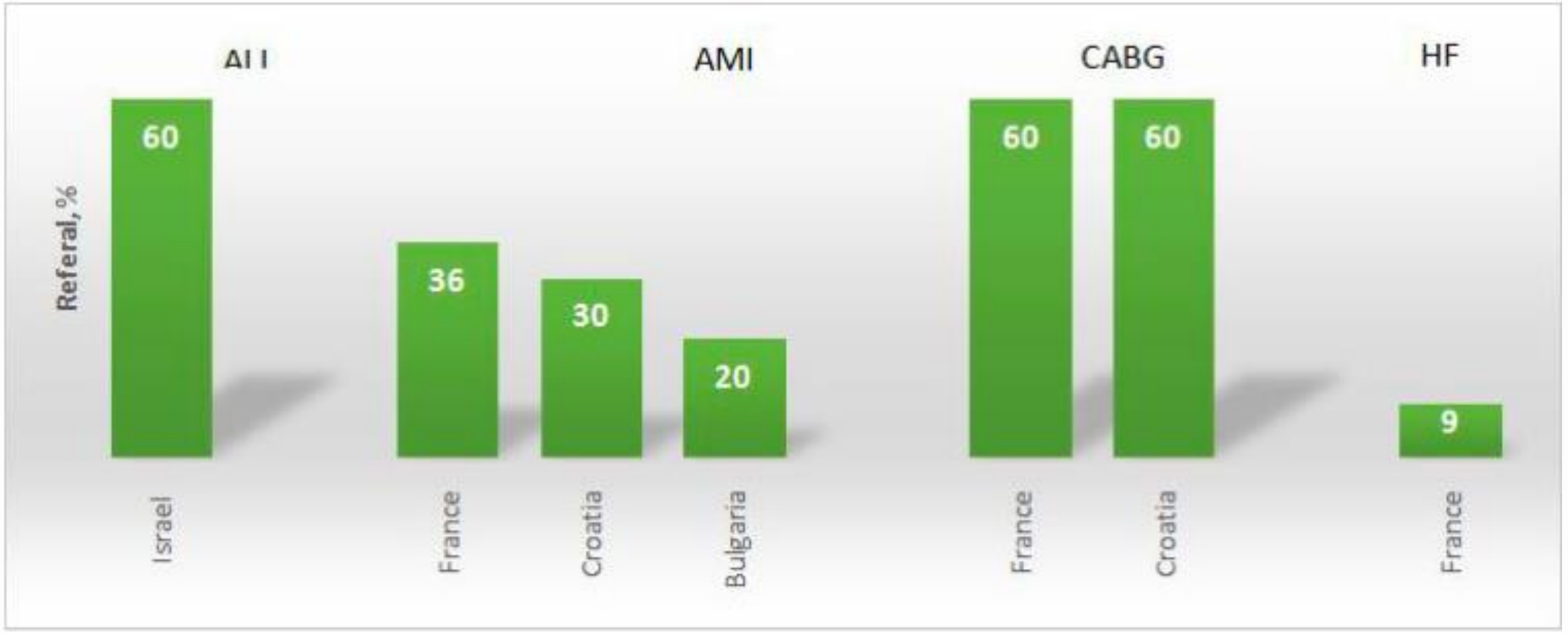
Challenges in cardiac rehabilitation



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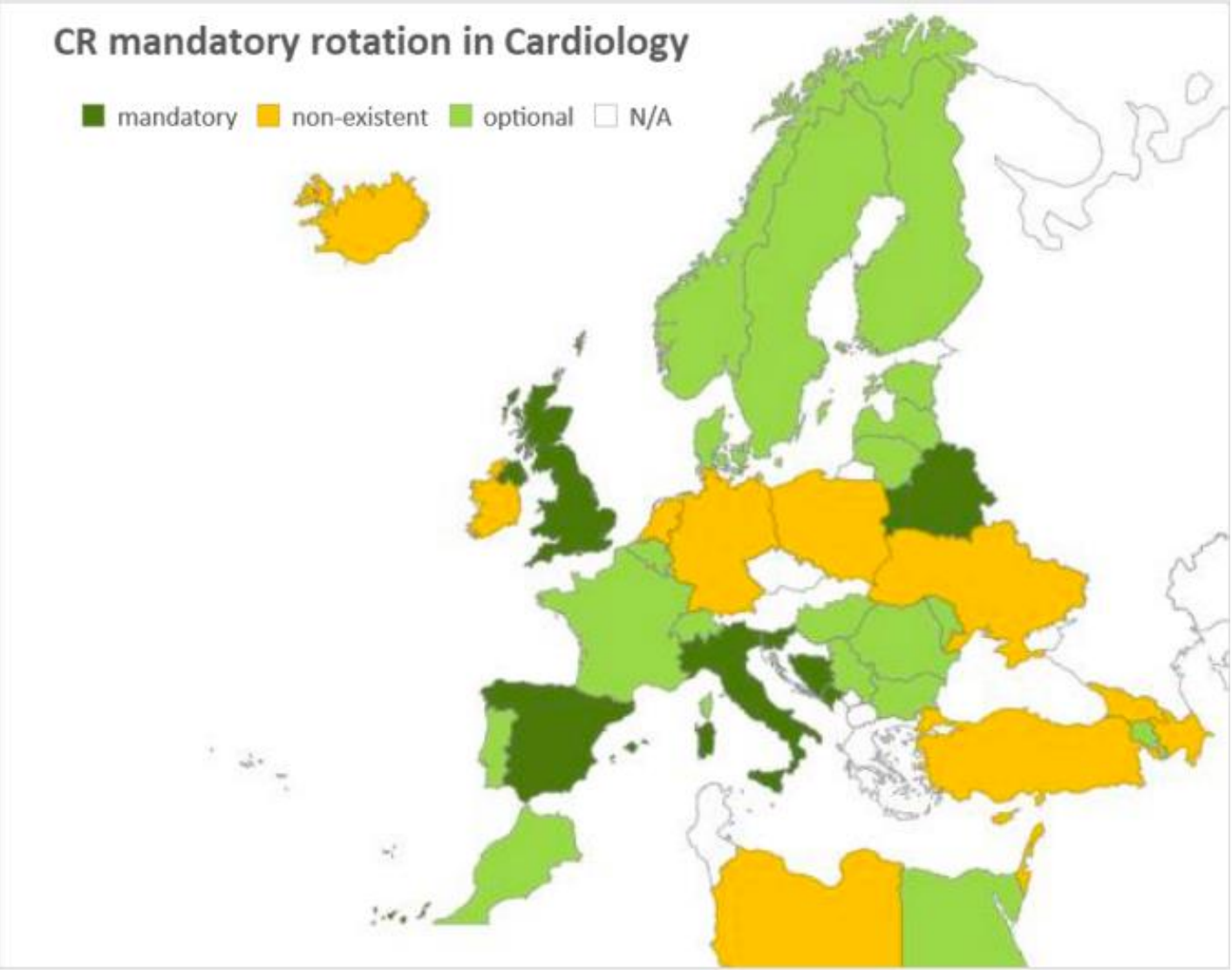
OCRE 2.0. ESCardio.org



8 countries: mandatory
13 countries: non-existent
21 countries: optional

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Remote cardiac rehabilitation programme

Rehab+ programme

- Prospective, observational, control-matched trial
- Study sample 900 ACS patients
- 1:2 mobile telemonitoring vs regular programme
- Primary endpoint: QoL at 1 year measured by the SF-36 questionnaire
- Actual inclusions: >200

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Cost-effectiveness

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Economic analysis of treatments reducing coronary heart disease mortality in England and Wales, 2000–2010

D. FIDAN[1]*, B. UNAL[1,2], J. CRITCHLEY[3] and S. CAPEWELL[1]

Costs per life-year gained (LYG)	
Aspirin and beta-blockers (secondary prev)	<£1000
ACE-inhibitor	£3398
Statins (primary prev)	£14557
Statins (secondary prev)	£4246
Primary angioplasty for myocardial infarction	£6054
Angioplasty (elective)	£3845
CABG	£3239
Cardiac rehabilitation	**£1957**

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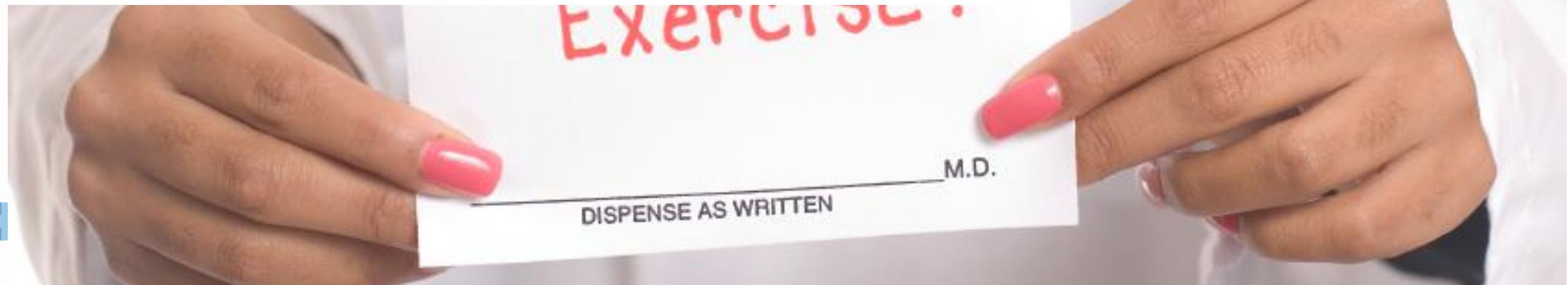
Fidan. Q J Med. 2007

Cost-effectiveness of CR

- 2018 systematic review including 19 economic studies regarding CR
- Cost conversion to 2016 US Dollar

- General CR vs no CR
  - Positive net cost, but all showed an increase in health
  - Incremental cost-effectiveness ratio range from USD 1065 – 71755 per QALY
  - Exercise-based CR vs no CR was most cost-effective;
    - USD 1065 per QALY,
    - USD 2555-3367 per LYG


Exercise
M.D.
DISPENSE AS WRITTEN

Literature