



Bewegen een Hoofdzaak

Dr. Nico Weerkamp

bewegingswetenschapper/neuroloog/athleet

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Contact

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Volgen

CV

- Bewegingswetenschapper Universiteit van Maastricht (skeletspierfysiologie)
- Geneeskunde/ Neuroloog, aandachtsgebied bewegingstoornissen (gepromoveerd op Parkinson bij Bas Bloem)
- Oprichter Bewegen een Hoofdzaak

Historie

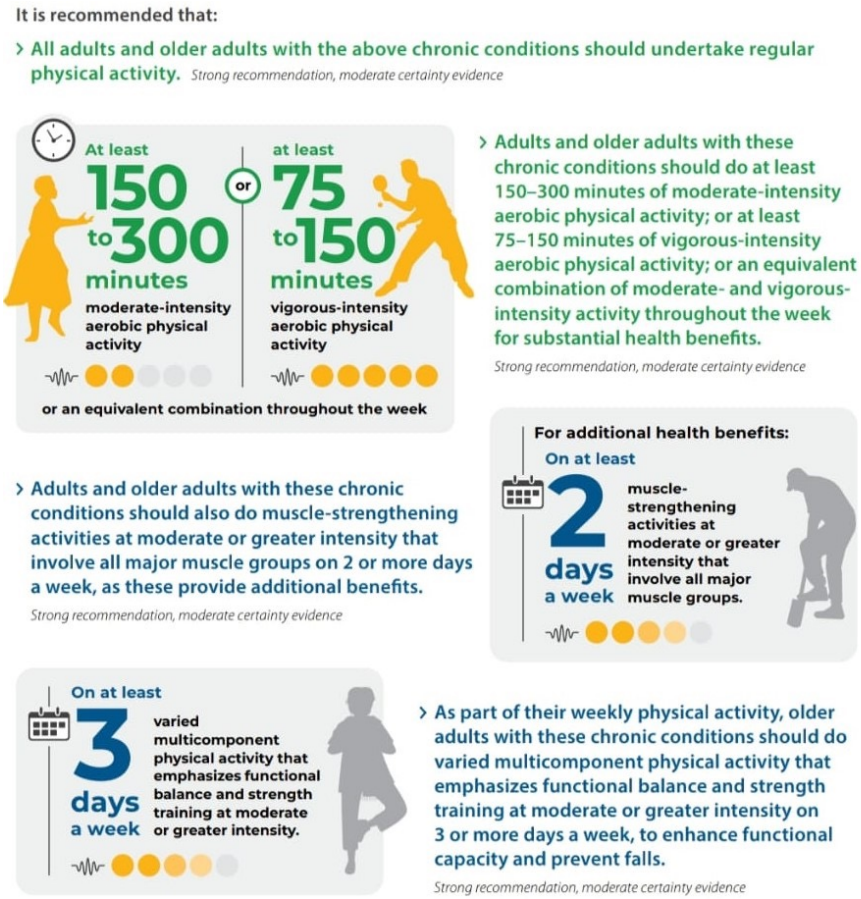
- Hippocrates geloofde in de waarde van fysieke activiteit voor gezondheid
- In 20^{e} eeuw dacht men dat bewegen en sport gevaarlijk waren
- Patiënten met hartinfarct kregen complete bedrust!
- In ’54 bij Oxford-Cambridge boat race werd studie verricht naar gevaren van sport

- In ’53 eerste epidemiologische studies naar fysieke inactiviteit en chronische ziekten
- Sindsdien veel bewijs dat duidelijk de benefits van fysieke activiteit laat zien
- Ondanks dit bewijs is een groot deel van de wereldbevolking fysiek inactief

Programma

- Bewegingsarmoede als grootste risicofactor
- Wat is aerobe fitness
- Epidemiologie
- Effect op welke orgaansystemen/ziektes
- Mechanismen (hoe werkt het)
- Hoeveel en intensief bewegen?
- Vergelijk met pillen

WHO richtlijn fysieke activiteit 2021



www.who.int/publications

Aerobe fitness

- = fitheid = conditie: tijdens cardiovasculaire conditie nemen ademhaling en hartslag gedurende een langere periode toe (minuten tot uren)

- Type inspanning maakt niet uit; wandelen, fietsen rennen, roeien, spelsport etc.

- Anaerobe inspanning zijn korte uitbarstingen van energie korte tijd met (sub) maximale inspanning gedaan. Springen, sprinten, zwaar tillen

VO2 max



VO2max schatting

- (HR max /HR rust) x 15
- Coopertest (d – 505)/45
- Shuttle run
- Fiets test met Wattage (een Watt is een J/s)

Fitheid kan je niet zomaar zien..

- Lengte, Gewicht/ BMI
- Bloeddruk
- Suiker
- Roken
- Etc zijn makkelijk te meten





Available online at www.sciencedirect.com

ScienceDirect

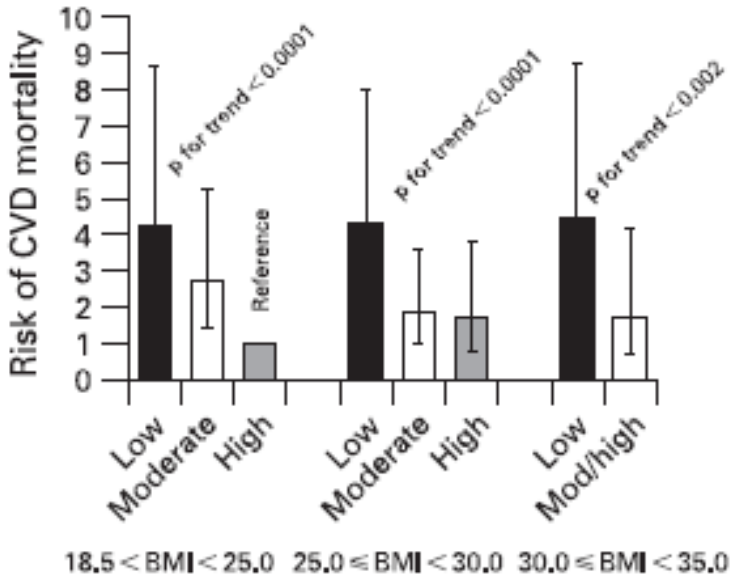
www.onlinepcd.com

Progress in Cardiovascular Diseases

Fitness vs. Fatness on All-Cause Mortality: A Meta-Analysis

Vaughn W. Barry[a,*], *Meghan Baruth*[b], *Michael W. Beets*[c], *J. Larry Durstine*[c], *Jihong Liu*[d], *Steven N. Blair*[c, d]

[a]Health and Human Performance, Middle Tennessee State University, Murfreesboro, TN
[b]Health Science, Saginaw Valley, State University, University Center, MI
[c]Exercise Science, University of South Carolina, Columbia, SC
[d]Epidemiology and Biostatistics, University of South Carolina, Columbia, SC



Progress in cardvasc res. 2014

Onderzoek

Onderzoek: Overgewicht geen excuus om niet fit te zijn

“Obesitas staat alleen in verband met een slechtere gezondheid in mensen die niet fit zijn”. Het is één van de conclusies uit het recente onderzoek van York University. Meer bewegen is dan ook altijd voordelig, ook als dit niet direct tot afvallen leidt.

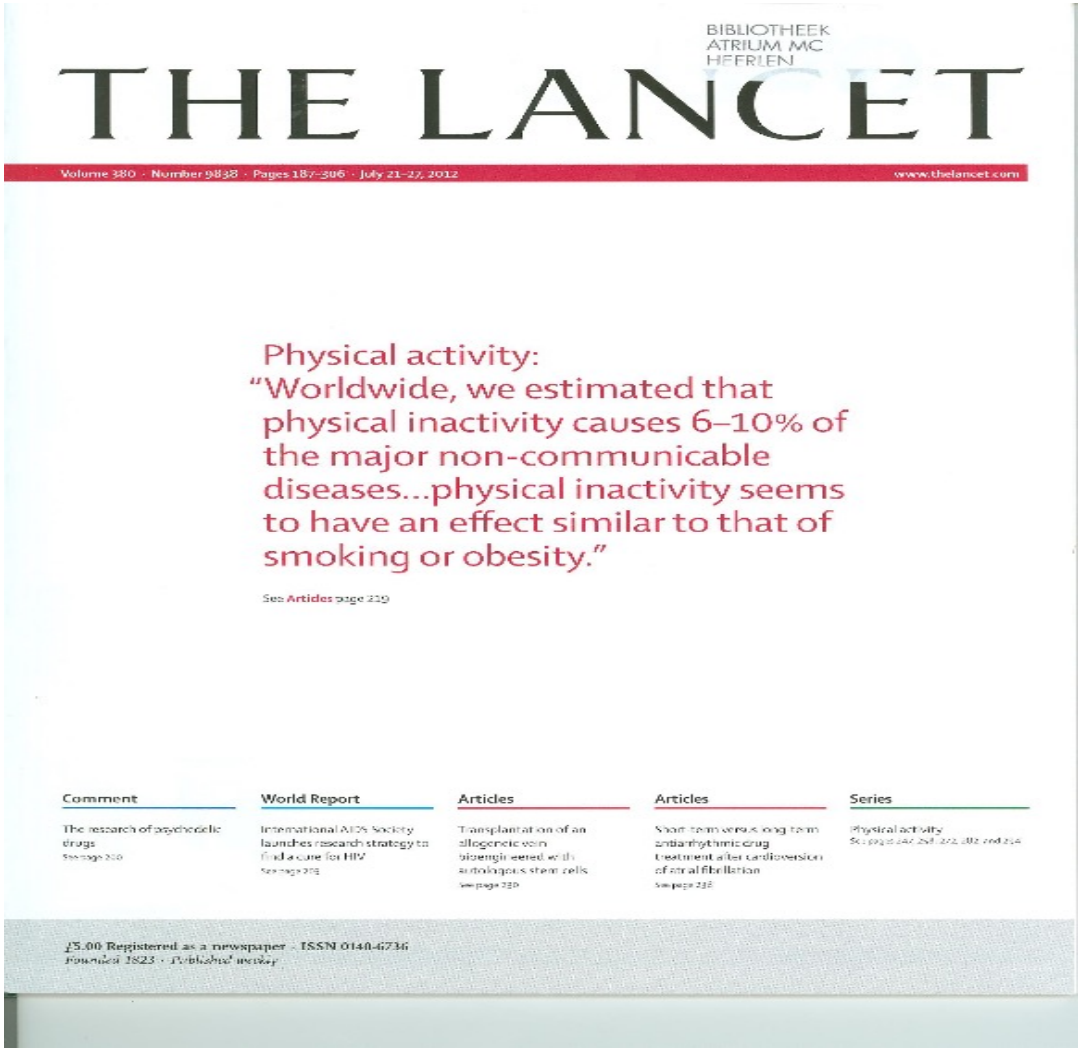
Fitheid minstens zo belangrijk als gewicht

“Kan je fit zijn als er sprake is van ernstig overgewicht?” Die vraag wilden de onderzoekers beantwoorden.

In gevallen van ernstig overgewicht worden hieraan vaak automatisch nadelige gevolgen voor de gezondheid gekoppeld. Denk onder andere aan hart- en vaatziekten, hoge bloeddruk en diabetes. Volgens de onderzoekers van York University zijn veel van deze gevolgen net zozeer, of zelfs meer, te wijten aan het gebrek aan lichaamsbeweging. Het gewicht zelf zou niet het (enige) probleem hoeven te vormen. Uit het onderzoek blijkt bijvoorbeeld dat ook mensen met een BMI hoger dan 40 een vergelijkbaar gezondheidsprofiel kunnen hebben als mensen die veel minder wegen.

> *Obesity is only related with worse health in individuals who were unfit*
>
> Jennifer Kuk, York University’s School of Kinesiology and Health Science

Lancet en WHO



Lancet, 2012

Physical Activity 5

The pandemic of physical inactivity: global action for public health

*Harold W Kohl 3rd, Cora Lynn Craig, Estelle Victoria Lambert, Shigeru Inoue, Jasem Ramadan Alkandari, Grit Leetongin, Sonja Kahlmeier, for the Lancet Physical Activity Series Working Group**

Physical inactivity: the biggest public health problem of the 21st century

Steven N Blair

Lancet 2012

Br J Sports Med 2009

Panel 1: Health benefits of physical activity in adults[3-5]

Strong evidence of reduced rates of:

- All-cause mortality
- Coronary heart disease
- High blood pressure
- Stroke
- Metabolic syndrome
- Type 2 diabetes
- Breast cancer
- Colon cancer
- Depression
- Falling

Strong evidence of:

- Increased cardiorespiratory and muscular fitness
- Healthier body mass and composition
- Improved bone health
- Increased functional health
- Improved cognitive function

Lancet 2012

JAMA Network Open

Original Investigation | Cardiology

Association of Cardiorespiratory Fitness With Long-term Mortality Among Adults Undergoing Exercise Treadmill Testing

Kyle Mandsager, MD; Serge Harb, MD; Paul Cremer, MD; Dermot Phelan, MD, PhD; Steven E. Nissen, MD; Wael Jaber, MD

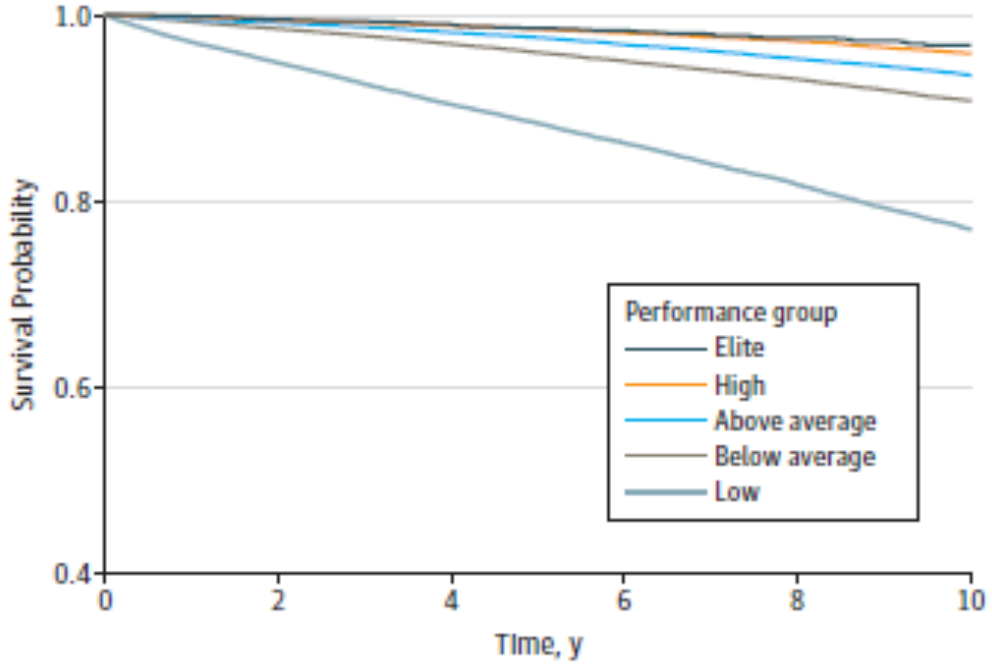
- 122 duizend patienten (53 jaar oud)
- 8.4 jaar gevolgd
- Getest met METs op treadmill

JAMA 2018

Table 1. Patient Demographics[a]

Demographic	All Patients (N = 122 007)	Performance Group				
		Low (n = 29 181)	Below Average (n = 27 172)	Above Average (n = 31 897)	High (n = 30 187)	Elite (n = 3570)
Age, mean (SD), y	53.4 (12.6)	53.7 (12.5)	53.2 (12.7)	53.3 (12.5)	53.5 (12.6)	53.3 (12.6)
Male	72 173 (59.2)	17 496 (60.0)	15 333 (56.4)	19 040 (59.7)	18 073 (59.9)	2231 (62.5)
Maximum No. of METs, mean (SD)	9.0 (2.7)	6.1 (1.7)	8.2 (1.6)	9.6 (1.7)	11.4 (1.8)	13.8 (1.5)
Estimated METs, mean (SD), %	101.2 (27.1)	68.0 (15.4)	92.5 (8.6)	107.6 (10.3)	128.0 (15.7)	155.9 (23.5)
BMI, mean (SD)	28.7 (5.8)	31.7 (7.3)	29.8 (5.5)	28.0 (4.6)	26.2 (3.9)	24.5 (3.4)
CAD	19 197 (15.7)	6472 (22.2)	4411 (16.2)	4409 (13.8)	3551 (11.8)	354 (9.9)
CABG or PCI	10 735 (8.8)	3975 (13.6)	2393 (8.8)	2350 (7.4)	1843 (6.1)	174 (4.9)
Diabetes	14 115 (11.6)	6387 (21.9)	3537 (13.0)	2590 (8.1)	1514 (5.0)	87 (2.4)
Hypertension	53 307 (43.7)	16 820 (57.6)	12 998 (57.8)	12 693 (39.8)	9846 (32.6)	2620 (26.6)
Hyperlipidemia	32 953 (27.0)	7323 (25.1)	7114 (26.2)	8552 (26.8)	8836 (29.3)	1128 (31.6)
ESRD	1385 (1.1)	900 (3.1)	251 (0.9)	148 (0.5)	79 (0.3)	7 (0.2)
Current or prior smoker	55 577 (45.6)	16 522 (56.6)	13 292 (48.9)	13 732 (43.1)	11 014 (36.5)	1017 (28.5)
Medication use						
Aspirin	40 680 (33.3)	11 353 (38.9)	9137 (33.6)	10 055 (31.5)	9051 (30.0)	1084 (30.4)
β-Blocker	29 620 (24.3)	10 975 (37.6)	6770 (24.9)	6476 (20.3)	4957 (16.4)	442 (12.4)
Statin	32 000 (26.2)	8617 (29.5)	7177 (26.4)	7991 (25.1)	7360 (24.4)	855 (24.0)
Follow-up, median (IQR), y	8.4 (4.3-13.4)	7.9 (3.8-13.1)	9.0 (4.5-14.2)	8.9 (4.6-14.1)	8.2 (4.3-12.8)	7.1 (3.8-10.7)
Death (all-cause)	13 637 (11.2)	6904 (23.7)	2888 (10.6)	2340 (7.3)	1412 (4.7)	93 (2.6)

Figure 1. Patient Survival by Performance Group



CONCLUSIONS AND RELEVANCE Cardiorespiratory fitness is inversely associated with long-term mortality with no observed upper limit of benefit. Extremely high aerobic fitness was associated with the greatest survival and was associated with benefit in older patients and those with hypertension.

Welke parameters

- Hoge bloeddruk
- Hoog cholesterol
- Hart- en vaatziekten
- Suikerziekte
- Osteoporose (botontkalking)
- Artrose

- Hersenen, cognitie en gedrag

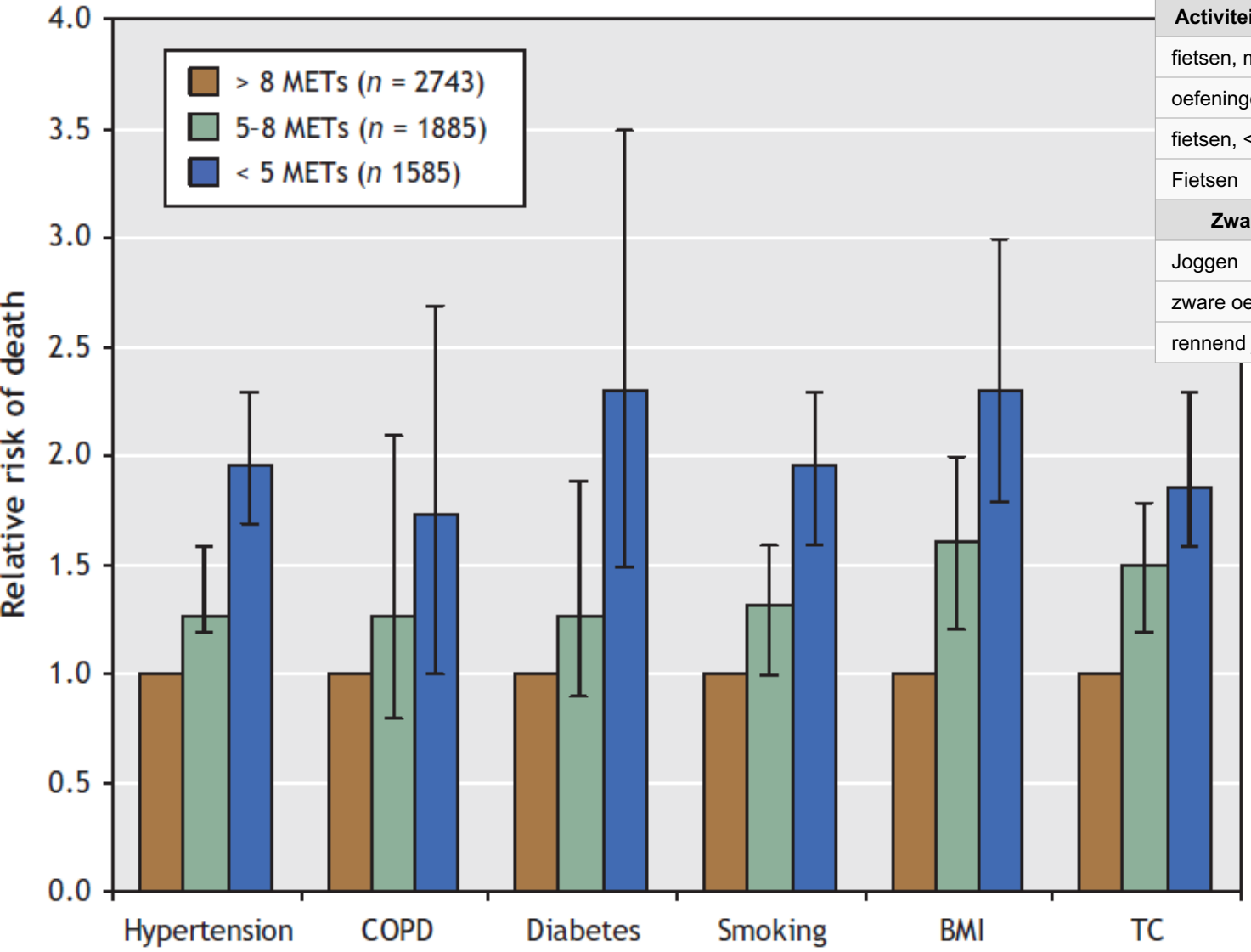
REVIEW

Health benefits of physical activity: the evidence

- Het voorkomen van fysieke inactiviteit (50%) is hoger dan die van alle andere risicofactoren (roken, overgewicht, hoge bloeddruk, suikerziekte)

CMAJ 2006

Fysieke activiteit	MET
Lichte activiteiten	**< 3**
Slapen	0.9
televisie kijken	1.0
schrijven, typen	1.8
lopen tot 3.2 km/h)	2.0
Activiteit met gemiddelde intensiteit	**3 to 6**
fietsen, met lichte inspanning	3.0
oefeningen zonder apparaten	3.5
fietsen, <16 km/h	4.0
Fietsen	5.5
Zware intensieve activiteiten	**> 6**
Joggen	7.0
zware oefeningen zonder apparaten	8.0
rennend joggen	8.0



Cholesterol (131 studies, n=23000)

Sports Medicine (2022) 52:1161–1173
https://doi.org/10.1007/s40279-021-01607-6

SYSTEMATIC REVIEW

Effectiveness of Fixed-Dose Combination Therapy (Polypill) Versus Exercise to Improve the Blood-Lipid Profile: A Network Meta-analysis

Vicente Martínez-Vizcaíno[1,2] · Francisco J. Amaro-Gahete[3,4] · Rubén Fernández-Rodríguez[1] · Miriam Garrido-Miguel[1] · Iván Cavero-Redondo[1,5] · Diana P. Pozuelo-Carrascosa[1,6,7]

Conclusions Considering that both polypills and exercise are effective in reducing LDL-c and TC but only exercise improves HDL-c and triglycerides, and that exercise provides further health benefits (e.g., increases in physical fitness and decreases in adiposity), it seems reasonable to recommend exercise as the first treatment option in dyslipidemia when the patient's general condition and symptoms allow it.



Sports med 2022

Diabetes mellitus (suikerziekte)

- Wereldwijd 463 miljoen mensen
- In NL 1.2 miljoen. 90 % type 2 diabetes (150 de novo elke dag)

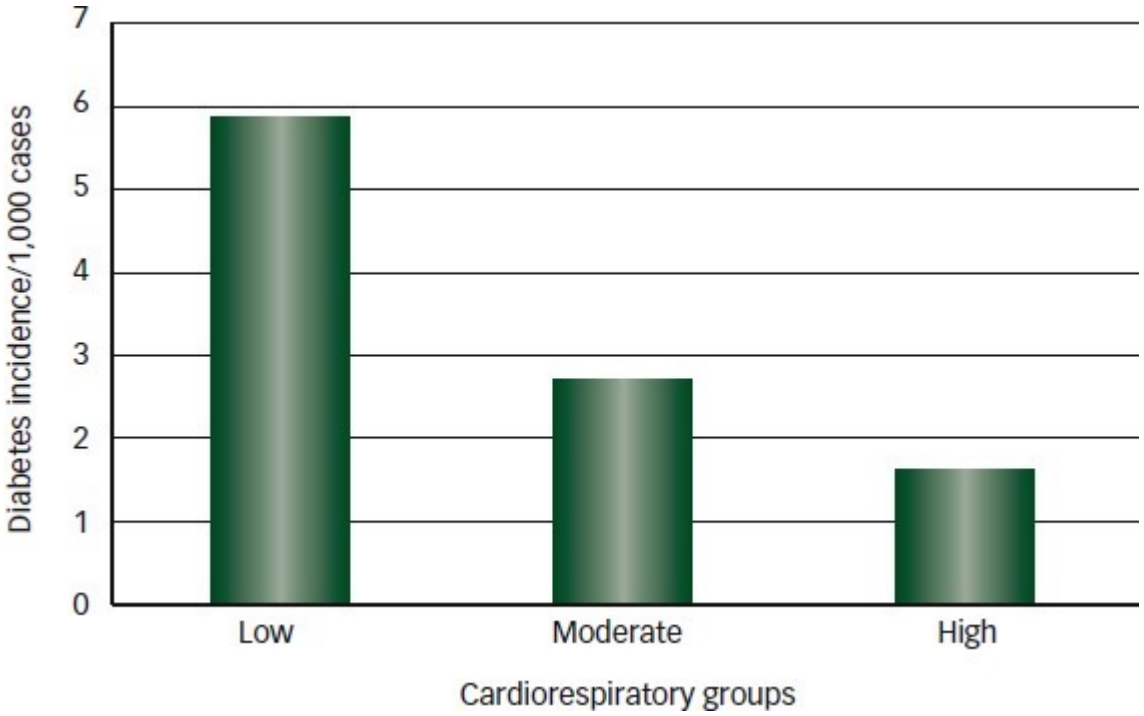


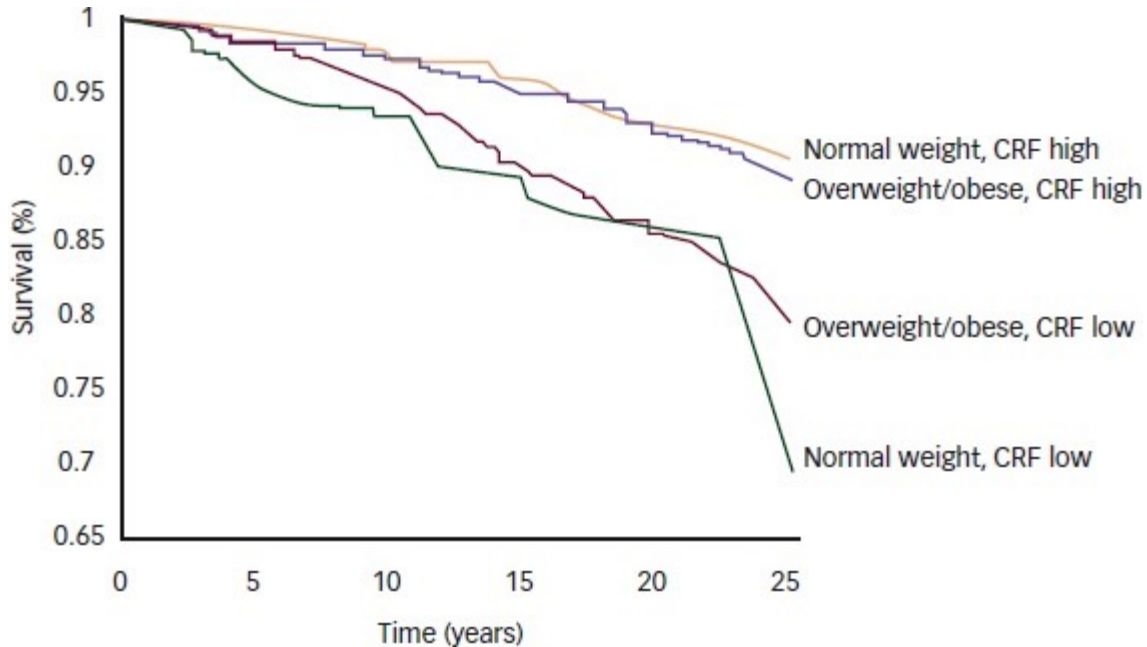
Diabetes mellitus

- Start medicijnen (orale anti diabetica), na 5 jaar 50% insuline

- Dit is geen genezing en lost de ziekte niet op

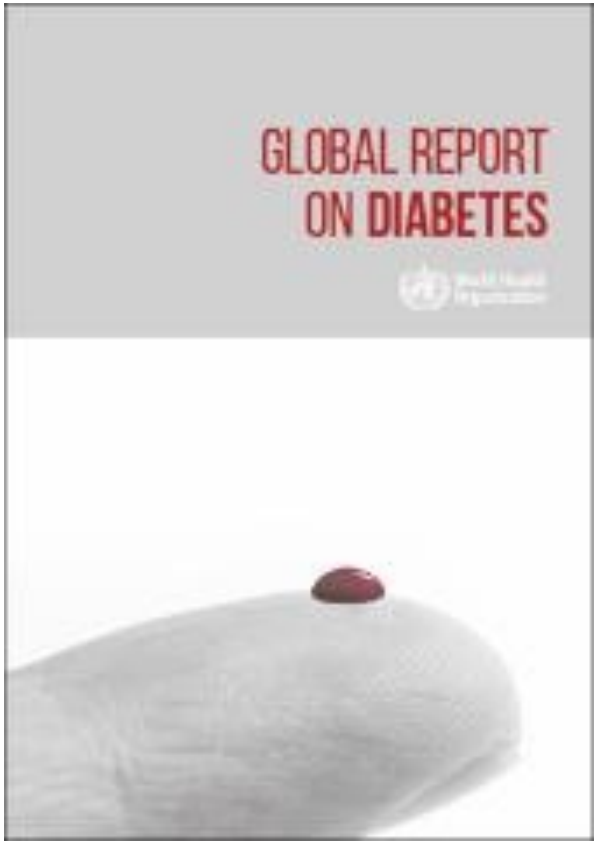
Halberg,
Nutrients 2009


Diabetes incidence/1,000 cases
7
6
5
4
3
2
1
0
Low
Moderate
High
Cardiorespiratory groups


Survival (%)
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0
5
10
15
20
25
Time (years)
Normal weight, CRF high
Overweight/obese, CRF high
Overweight/obese, CRF low
Normal weight, CRF low

WHO reverse diabetes project

- Voeding
- Gewichtsreductie
- Bewegen



REVIEW

Ischaemic stroke in young adults: a global perspective

Esther Boot,[1] Merel Sanne Ekker ,[1] Jukka Putaala,[2] Steven Kittner,[3]
Frank-Erik De Leeuw,[1] Anil M Tuladhar [1]

- Toename van fysieke activiteit geeft afname beroertes door:

  - bloeddruk ↓
  - cholesterol ↓
  - vernauwing slagaders ↓

Boot et al, JNNP 2020

Stroke

Table 1 Modifiable risk factors and their risk of ischaemic stroke

Risk factor	OR (95% CI)	PAR (95% CI)
Diabetes mellitus type 1*	6.72 (3.15 to 14.33)	3.9 (3.1 to 4.3)
Diabetes mellitus type 2*	2.31 (1.35 to 3.95)	2.6 (1.2 to 3.4)
Hypertension*	1.43 (1.17 to 1.75)	19.9 (14.8 to 23.9)
Dyslipidaemia†	0.9 (0.8 to 1.1)	–2.1 (-6.7 to 2.6)
Obesity†	1.2 (1.0 to 1.5)	6.9 (0.0 to 13.8)
Physical inactivity†	5.9 (5.1 to 6.7)	59.8 (56.2 to 63.4)
Current smoking*	1.81 (1.50 to 2.17)	15.0 (8.1 to 21.8)

Oncologie

- Fysieke activiteit geeft afname van met name borst- en darmkanker

- 30-40% afname darm kanker
- 20-30% afname voor borstkanker



Lancet 2020

Journal of
Clinical Medicine

MDPI

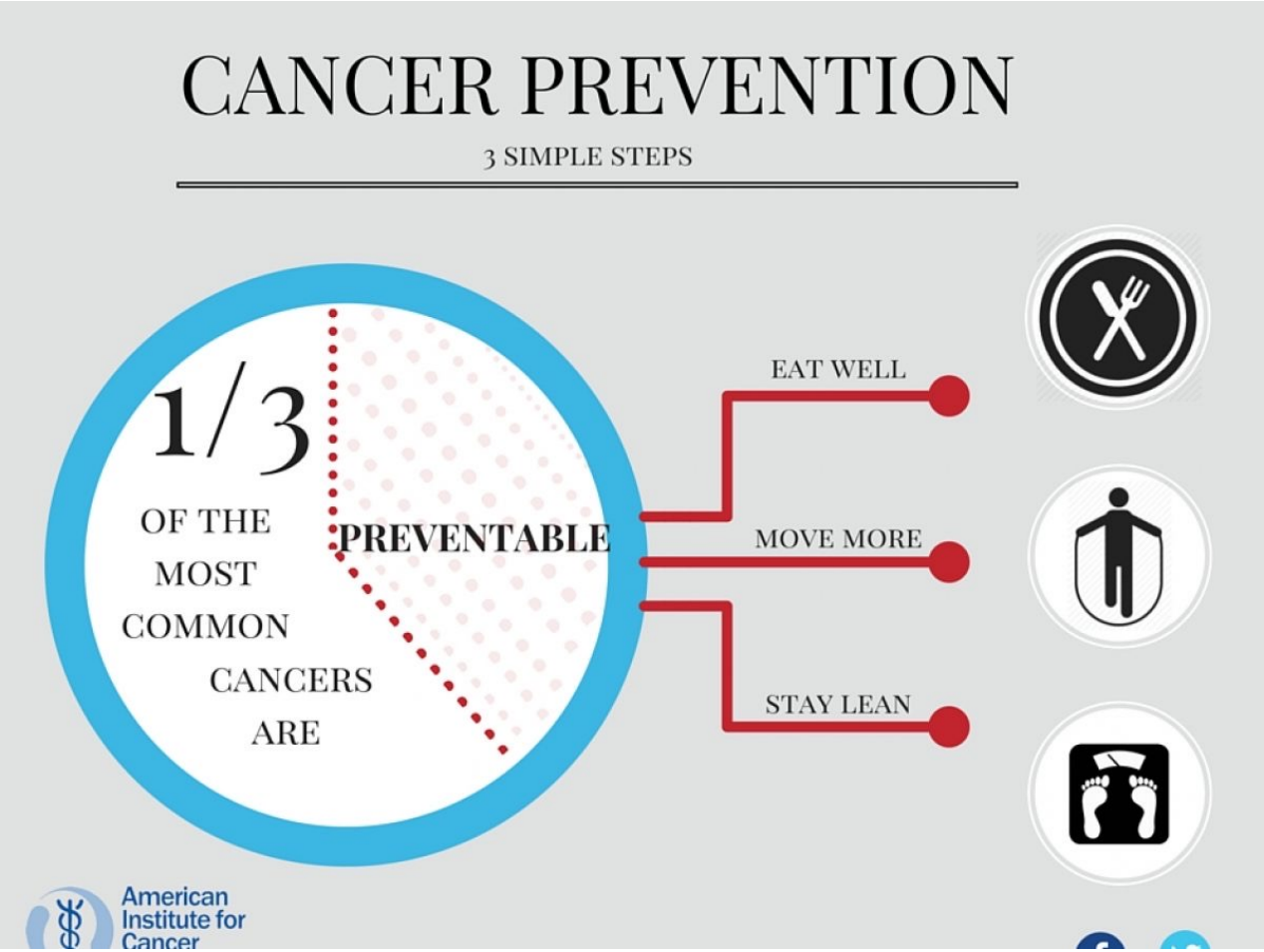
Review

Resting Heart Rate as a Predictor of Cancer Mortality: A Systematic Review and Meta-Analysis

- Een rustpols van 60 slagen/min geeft ivm een rustpols van 80 slagen per minuut 35% minder kans op kanker

Journal of clinical Medicine 2020

Study: Vast majority of cancers caused by lifestyle, not "bad luck"



Nature 2015

Het Bewegingsapparaat

- Nodig om fit te worden/blijven
- Veel patiënten met bewegingsapparaat pijn
- Vaak geen classificerende diagnose
- Veel angst voor ‘slijtage’
- Cognities dat bewegen kwaad doet en slijtage meer maakt

- Röntgen en MRI bevindingen zijn heel matig gecorreleerd met klachten

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Physical Therapy versus Glucocorticoid Injection for Osteoarthritis of the Knee

Gail D. Deyle, D.Sc., Chris S. Allen, D.Sc., Stephen C. Allison, Ph.D., Norman W. Gill, D.Sc., Benjamin R. Hando, D.Sc., Evan J. Petersen, D.Sc., Douglas I. Dusenberry, M.S., and Daniel I. Rhon, D.Sc.

- Studie opzet: 2 groepen van 78 patienten (56 jr oud gemiddeld)

- 1. Fysiotherapie: rekken (actief en passief)
- 2. injectie met steroiden

- Uitkomst: score na 1 jaar op WOMAC (0-240)

NEJM 2020

Table 2. Primary and Secondary Outcomes at 1 Year.*

Outcome	Glucocorticoid Injection	Physical Therapy	Mean Between-Group Difference (95% CI)
Primary outcome: total WOMAC score — least-squares mean (95% CI)	55.8 (45.0–69.1)	37.0 (30.8–44.5)	18.8 (5.0–32.6)†
Secondary outcomes			
Median Global Rating of Change score (IQR)‡	+4 (0.5–6.0)	+5 (3.3–6.0)	
Least-squares mean time to complete Alternate Step Test — sec (95% CI)	9.0 (8.5–9.5)	8.0 (7.6–8.4)	1.0 (0.3–1.6)§
Least-squares mean time to complete Timed Up and Go test — sec (95% CI)	8.1 (7.7–8.6)	7.3 (6.8–7.7)	0.9 (0.3–1.5)¶

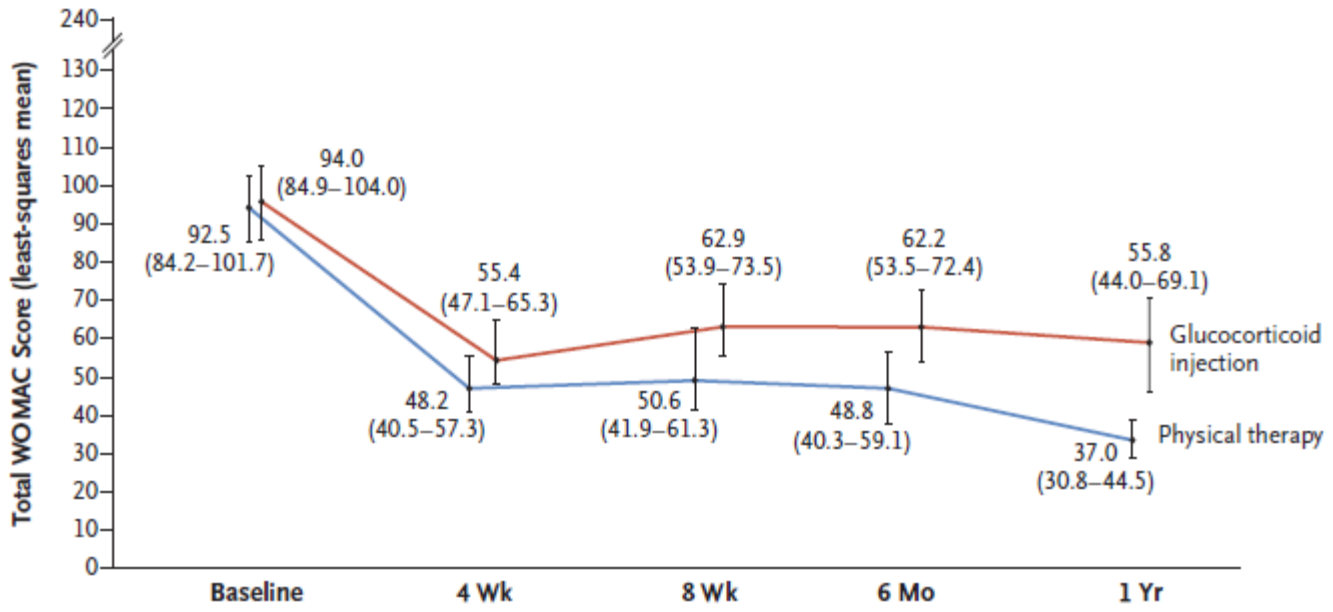


Figure 2. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Total Scores over the 12-Month Follow-up Period.

WOMAC total scores range from 0 to 240, with higher scores indicating worse pain, function, and stiffness. The values in parentheses are 95% confidence intervals (also indicated by the I bars). All 156 participants (78 per group) were included in the analysis.

Osteoporose

CLINICAL TRIAL

JBMR®

High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women With Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial

Steven L Watson,[1,2] Benjamin K Weeks,[1,2] Lisa J Weis,[3] Amy T Harding,[1,2] Sean A Horan,[1,2] and Belinda R Beck[1,2,3]

JBMR 2017

Opzet studie

- 1:1 gerandomiseerd
- post-menopauzale vrouwen met osteoporose (gemiddeld 65 jaar oud)

- 49 HiT, 52 controles

- Home: unsupervised walking
- Supervised: 8 maanden, 2 keer per week 30 min 5x5 repetitions: deadlift, overhead press, back squat

Primaire uitkomstmaat

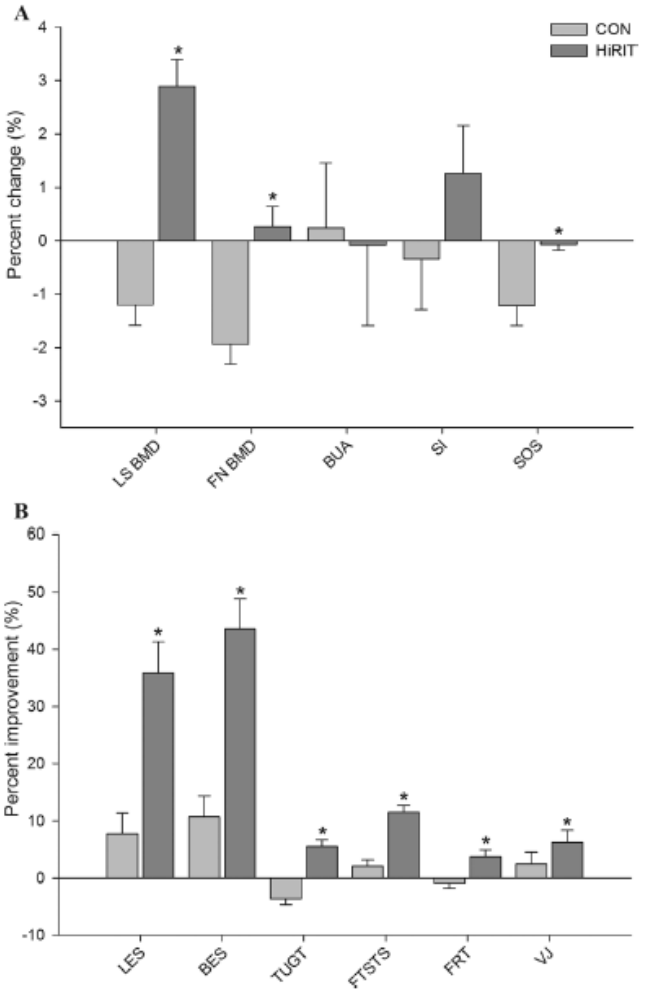
- Botdichtheid heup kop en lendewervels

- Andere uitkomstmaat: Timed up en go, kracht in rug- en beenspieren

Table 3. Baseline and 8-Month Measures (±SD) With Adjusted Percent Change in DXA and QUS-Derived Measures of Bone After an 8-Month Exercise Intervention in Postmenopausal Women With Low Bone Mass (Per Protocol Data, $n = 86$)

	CON ($n = 43$)			HiRIT ($n = 43$)			
Parameter	Baseline	Follow-up	% Change	Baseline	Follow-up	% Change	p Value
LS BMD (g/cm^2)	0.816 ± 0.097	0.807 ± 0.098[a]	−1.2 ± 3.1	0.823 ± 0.108	0.846 ± 0.116[a]	2.9 ± 3.1	<0.001[b]
FN BMD (g/cm^2)	0.682 ± 0.059	0.670 ± 0.059[a]	−2.0 ± 3.0	0.699 ± 0.086	0.700 ± 0.084	0.3 ± 3.0	0.025[b]
BUA (dB/MHz)	97.7 ± 11.8	98.4 ± 11.3	0.8 ± 7.6	98.0 ± 10.6	99.0 ± 13.2	1.0 ± 7.6	0.534
SI	74.9 ± 13.5	76.1 ± 12.5	2.0 ± 6.8	75.7 ± 12.7	77.7 ± 13.6	2.7 ± 6.8	0.200
SOS (m/s)	1535 ± 26	1538 ± 28	0.2 ± 1.1	1538 ± 25	1542 ± 27.5	0.3 ± 1.1	0.006[b]

-90 % maakt studie af
-Geen botbreuken



Pillen

- Polypil
- Aspirine, cholesterolverlager, 3 medicijnen tegen hoge bloeddruk



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Polypill with or without Aspirin in Persons without Cardiovascular Disease

S. Yusuf, P. Joseph, A. Dans, P. Gao, K. Teo, D. Xavier, P. López-Jaramillo, K. Yusoff, A. Santoso, H. Gamra, S. Talukder, C. Christou, P. Girish, K. Yeates, F. Xavier, G. Dagenais, C. Rocha, T. McCready, J. Tyrwhitt, J. Bosch, and P. Pais, for the International Polycap Study 3 Investigators*

- 5713 deelnemers (gem. 65 jaar) met risico
- 4.6 jaar vervolgd
- 1:1 gerandomiseerd

METHODS

Using a 2-by-2-by-2 factorial design, we randomly assigned participants without cardiovascular disease who had an elevated INTERHEART Risk Score to receive a polypill (containing 40 mg of simvastatin, 100 mg of atenolol, 25 mg of hydrochlorothiazide, and 10 mg of ramipril) or placebo daily, aspirin (75 mg) or pla-

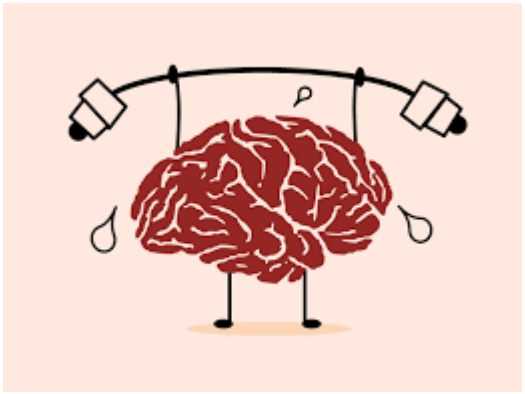
NEJM 2021

Table 2. Clinical Outcomes with the Polypill or Placebo.

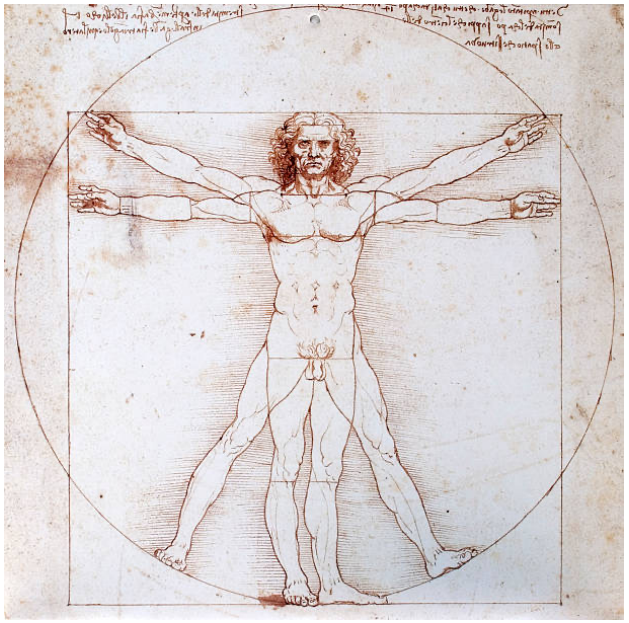
Outcomes	Polypill (N=2861)	Placebo (N=2852)	Hazard Ratio (95% CI)*
Primary outcome			
Death from cardiovascular causes, myocardial infarction, stroke, heart failure, resuscitated cardiac arrest, or arterial revascularization — no. (%)	126 (4.4)	157 (5.5)	0.79 (0.63–1.00)
Secondary outcomes			
Death from cardiovascular causes, myocardial infarction, or stroke — no. (%)	111 (3.9)	139 (4.9)	0.79 (0.61–1.01)
Death from cardiovascular causes, myocardial infarction, stroke, heart failure, resuscitated cardiac arrest, arterial revascularization, or angina with evidence of ischemia — no. (%)	132 (4.6)	164 (5.8)	0.79 (0.63–1.00)
Components of the primary and secondary outcomes			
Death from cardiovascular causes — no. (%)†	84 (2.9)	101 (3.5)	0.82 (0.61–1.09)
Myocardial infarction — no. (%)	17 (0.6)	26 (0.9)	0.66 (0.36–1.22)
Stroke — no. (%)	26 (0.9)	36 (1.3)	0.71 (0.43–1.18)
Heart failure — no. (%)	12 (0.4)	10 (0.4)	1.19 (0.51–2.74)
Resuscitated cardiac arrest — no. (%)	1(<0.1)	0	—
Arterial revascularization — no. (%)	12 (0.4)	25 (0.9)	0.48 (0.24–0.95)
Angina with evidence of ischemia — no. (%)	17 (0.6)	22 (0.8)	0.77 (0.41–1.44)
Other efficacy outcomes			
Death from any cause — no. (%)	149 (5.2)	163 (5.7)	0.90 (0.72–1.13)

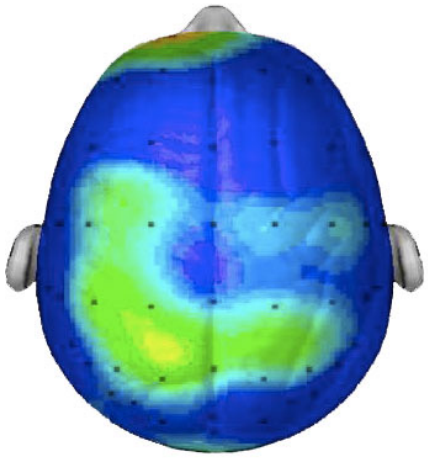
The primary outcome for the polypill comparison occurred in 126 participants (4.4%) in the polypill group and in 157 (5.5%) in the placebo group (hazard ratio, 0.79; 95% confidence interval [CI], 0.63 to 1.00). The primary outcome for the

Hersenen en bewegen

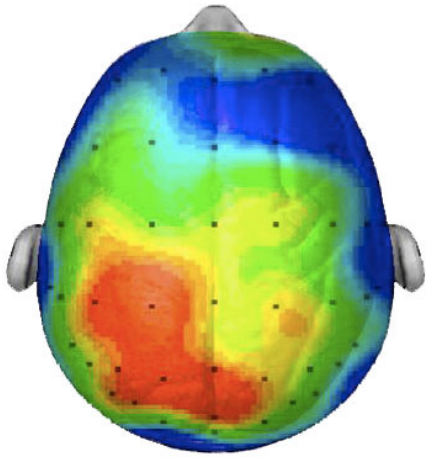


International Parkinson and Movement Disorder Society



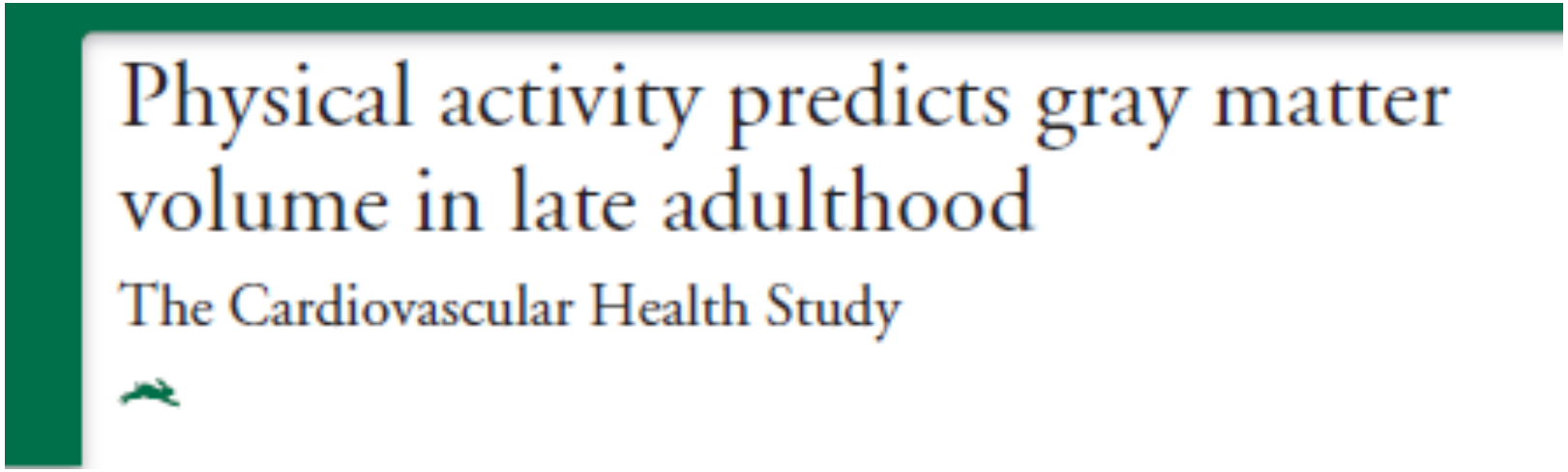


HERSENACTIVITEIT NA 20 MIN ZITTEN



HERSENACTIVITEIT NA 20 MIN WANDELEN

Hersengrootte en cognitie

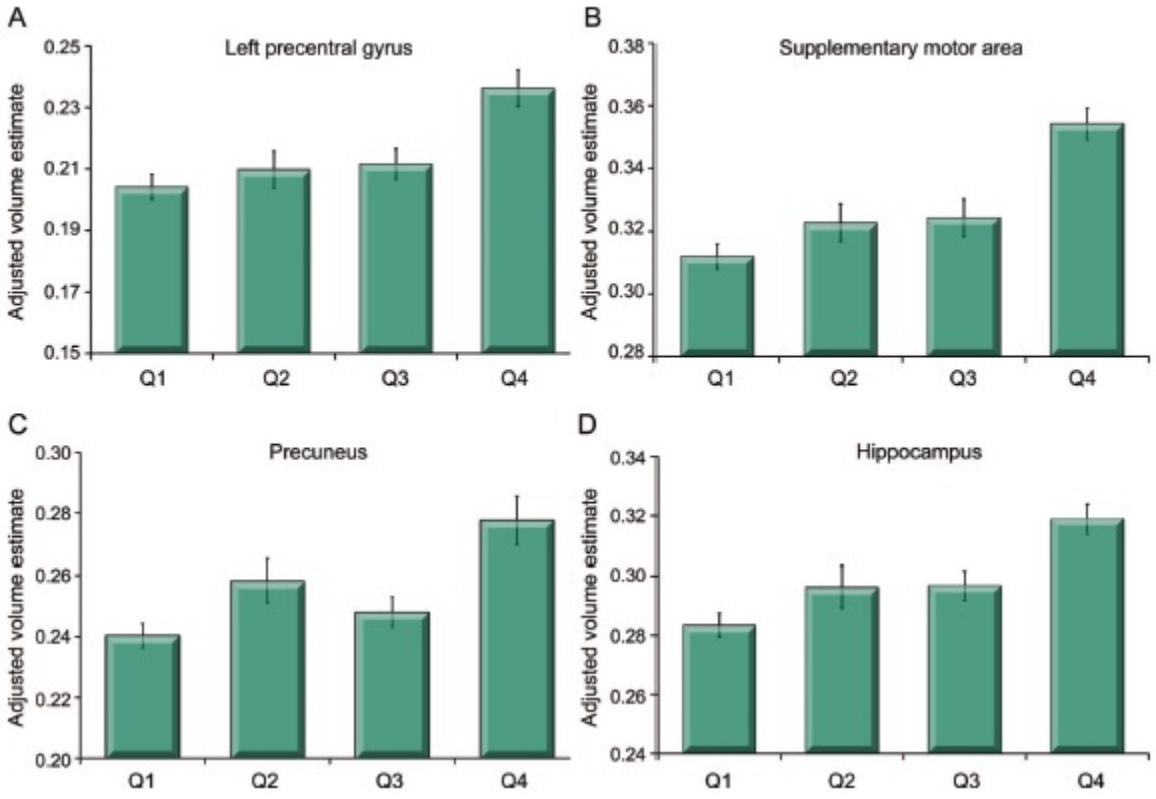


Erickson, Neurology 2010

Table 1 Demographic and health variables[a]

	Blocks walked				
	Quartile 1 (n = 91)	Quartile 2 (n = 57)	Quartile 3 (n = 78)	Quartile 4 (n = 73)	t Test or χ^2, p value
Blocks walked, mean (SD), min/max	7.8 (4.5), 0/12	21 (3.5), 13/24	45 (13.1), 25/70	156 (75), 72/300	−14.8, <0.001[b]
Age, y, mean (SD)	72.9 (3.7)	72.7 (3.7)	73.2 (3.6)	72.45 (3.61)	1.01, 0.31
Female (%)	66 (72.5)	29 (50.8)	51 (65.3)	35 (47.9)	6.41, 0.009[b]
Beyond grade 12 (%)	51 (56.0)	38 (66.6)	51 (65.3)	51 (69.8)	1.66, 0.21
African American (%)	17 (18.6)	12 (21.0)	8 (10.2)	14 (19.1)	0.31, 0.59
White matter grade 3+ (%)	17 (18.6)	6 (10.5)	13 (16.6)	13 (17.8)	0.14, 0.42
MRI-identified infarcts (%)	27 (29.6)	17 (29.8)	20 (25.6)	15 (20.5)	1.71, 0.22
Heart disease (%)	9 (9.8)	12 (21.0)	15 (19.2)	12 (16.4)	0.02, 0.85
Type II diabetes mellitus (%)	15 (16.4)	4 (12.9)	6 (19.4)	6 (19.4)	0.45, 0.66
Hypertension (%)	31 (30.7)	15 (7.0)	35 (44.8)	20 (27.3)	1.76, 0.21
Time taken to walk 15 ft, s, mean (SD)	5.72 (1.72)	5.07 (1.28)	5.42 (1.79)	4.74 (1.02)	3.18, 0.002[b]
3MSE, mean (SD)	94.71 (4.2)	95.3 (3.9)	94.8 (4.0)	94.8 (5.0)	0.18, 0.86
Digit Symbol Substitution Test, mean (SD)	48.1 (11.7)	48.5 (12.3)	48.1 (12.7)	49.0 (11.8)	−0.49, 0.63

Figure 3 Threshold effects on brain volume



Objectives: Physical activity (PA) has been hypothesized to spare gray matter volume in late adulthood, but longitudinal data testing an association has been lacking. Here we tested whether PA would be associated with greater gray matter volume after a 9-year follow-up, a threshold could be identified for the amount of walking necessary to spare gray matter volume, and greater gray matter volume associated with PA would be associated with a reduced risk for cognitive impairment 13 years after the PA evaluation.

Methods: In 299 adults (mean age 78 years) from the Cardiovascular Health Cognition Study, we examined the association between gray matter volume, PA, and cognitive impairment. Physical activity was quantified as the number of blocks walked over 1 week. High-resolution brain scans were acquired 9 years after the PA assessment on cognitively normal adults. White matter hyperintensities, ventricular grade, and other health variables at baseline were used as covariates. Clinical adjudication for cognitive impairment occurred 13 years after baseline.

Results: Walking amounts ranged from 0 to 300 blocks (mean 56.3; SD 69.7). Greater PA predicted greater volumes of frontal, occipital, entorhinal, and hippocampal regions 9 years later. Walking 72 blocks was necessary to detect increased gray matter volume but walking more than 72 blocks did not spare additional volume. Greater gray matter volume with PA reduced the risk for cognitive impairment 2-fold.

Conclusion: Greater amounts of walking are associated with greater gray matter volume, which is in turn associated with a reduced risk of cognitive impairment. *Neurology*® 2010;75:1415–1422

Exercise training increases size of hippocampus and improves memory

Kirk I. Erickson[a], Michelle W. Voss[b,c], Ruchika Shaurya Prakash[d], Chandramallika Basak[e], Amanda Szabo[f], Laura Chaddock[b,c], Jennifer S. Kim[b], Susie Heo[b,c], Heloisa Alves[b,c], Siobhan M. White[f], Thomas R. Wojcicki[f], Emily Mailey[f], Victoria J. Vieira[f], Stephen A. Martin[f], Brandt D. Pence[f], Jeffrey A. Woods[f], Edward McAuley[b,f], and Arthur F. Kramer[b,c,1]

- 120 ouderen
- 1 jaar lang intensief wandelen
- Controles stretching (n=60)
- Prospectieve studie, twee maal MRI scan

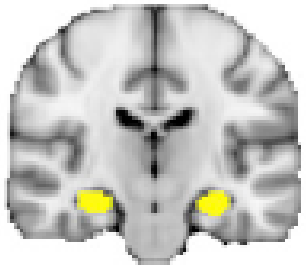
Kramer et al
PNAS 2011

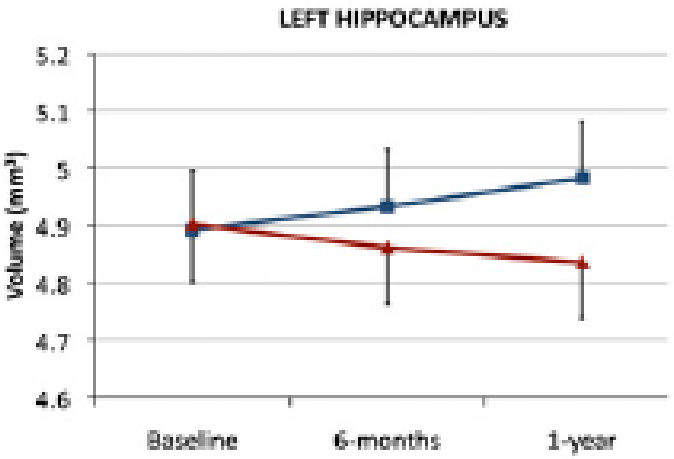
Table 1. Characteristics for the aerobic exercise and stretching control groups

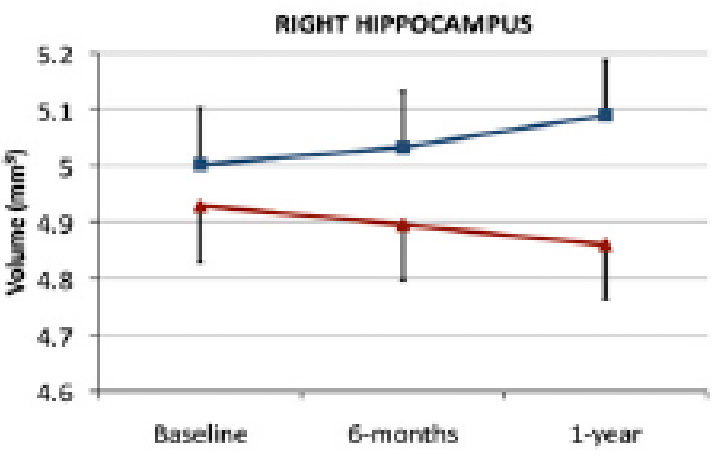
Characteristic	Aerobic exercise	Stretching control
n	60	60
Age (y), mean (SD)	67.6 (5.81)	65.5 (5.44)
Sex (% female)	73	60
Attendance (%), mean (SD)	79.5 (13.70)	78.6 (13.61)
Fitness improvement (%), mean (SD)	7.78 (12.7)	1.11 (13.9)

- Programma: 4 maal per week 40 min wandelen op 65-70% max heart rate
- MRI cerebrum baseline en na een jaar

A Hippocampus







- Toename BDNF in serum
- Verbetering in ruimtelijk geheugen

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Tai Chi and Postural Stability in Patients with Parkinson's Disease

Fuzhong Li, Ph.D., Peter Harmer, Ph.D., M.P.H., Kathleen Fitzgerald, M.D., Elizabeth Eckstrom, M.D., M.P.H., Ronald Stock, M.D., Johnny Galver, P.T., Gianni Maddalozzo, Ph.D., and Sara S. Batya, M.D.

- Studie design 1;1;1
- Tai chi, stretch en kracht (2x wk, 60min, 24 wk)

NEJM 2013

Table 3. Self-Reported Falls during the 6-Month Intervention, According to Group.*

Falls	Tai Chi (N=65)	Resistance (N=65)	Stretching (N=65)
Total falls†	62	133	186
No. of falls — no. of participants (%)			
Any	19 (29)	31 (48)	26 (40)
1	3 (5)	8 (12)	4 (6)
2	4 (6)	7 (11)	2 (3)
≥3	12 (18)	16 (25)	20 (31)
Rate — no./participant-month	0.22	0.51	0.62

Aerobic Exercise Alters Brain Function and Structure in Parkinson's Disease: A Randomized Controlled Trial

Martin E. Johansson, MSc,[1,2†] Ian G. M. Cameron, PhD,[3,4,5†] Nicolien M. Van der Kolk, MD, PhD,[2] Nienke M. de Vries, PhD,[2] Eva Klimars, MSc,[1,2] Ivan Toni, PhD,[1] Bastiaan R. Bloem, MD, PhD,[2] and Rick C. Helmich, MD, PhD[1,2]

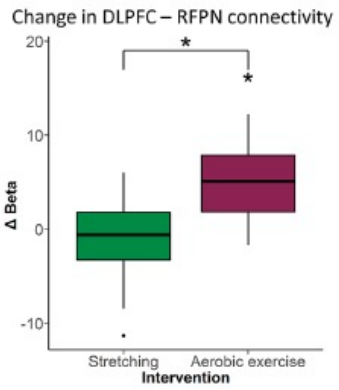
Johanson, Annals of Neurology 2021

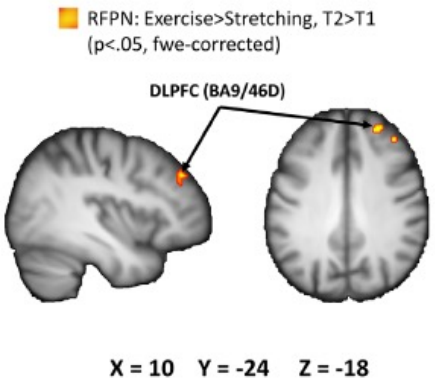
TABLE 1. Demographic Characteristics and Clinical Measurements at Baseline

	Aerobic Exercise	Active Control	$t/\chi^2/F^a$
Participants	26	31	
Age, yr	58.9 (8.9)	59.8 (10.1)	$p > 0.05$
Sex, M/F	20/6	17/14	$p = 0.082$
Disease duration, mo	44.4 (38.2)	47.5 (32.9)	$p > 0.05$

- Park in Shape trial, double blind randomized trial
- Baseline en 6 mnd follow up; klinisch, MRI hersenen en cognitie
- Exergaming; fietsen op 50-80% HRR, 3x/wk, 30-45min

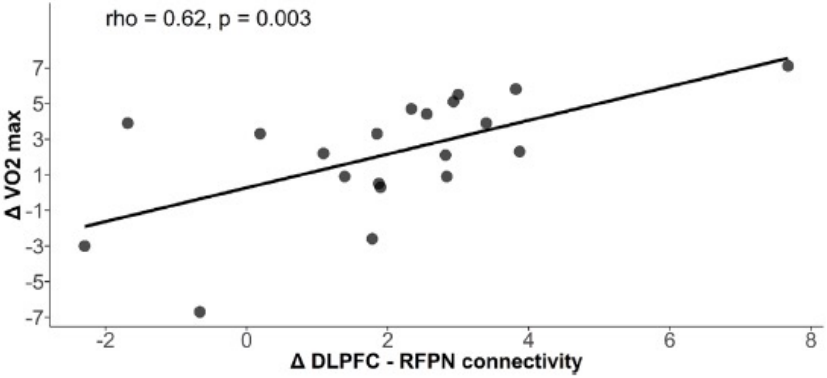
B **Effects of aerobic exercise on connectivity between dorsolateral prefrontal cortex and right frontoparietal network**



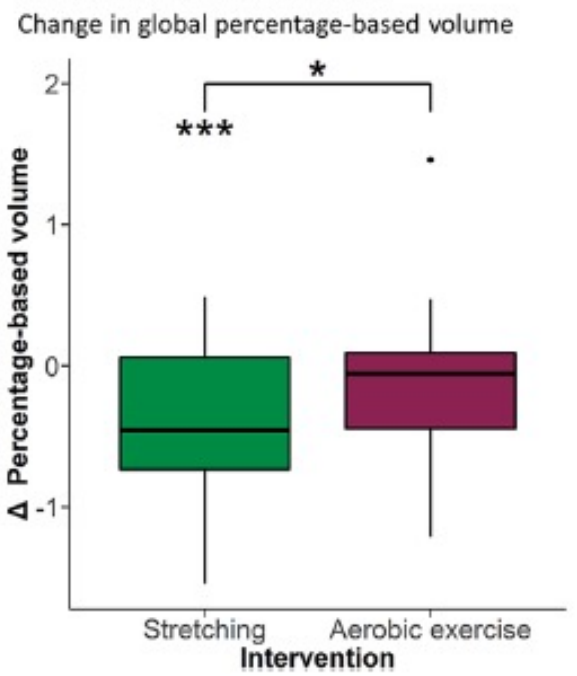


X = 10 Y = -24 Z = -18

C **Association between increased right frontoparietal network connectivity and improved fitness**



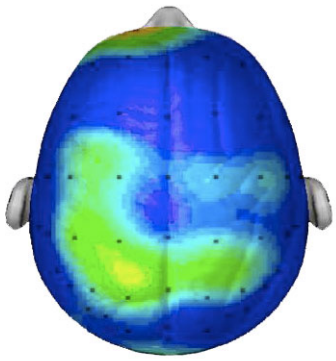
A **Effect of aerobic exercise on global brain atrophy**



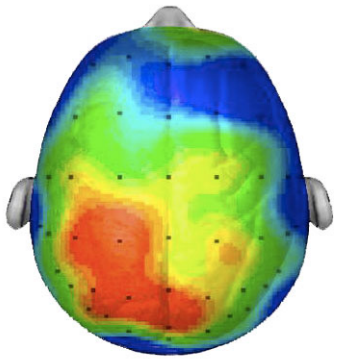
Mechanismen

- Epidemiologische kennis is al oud

- Maar meer inzicht in mechanismen door imaging, moleculaire technieken



HERSENACTIVITEIT
NA 20 MIN ZITTEN



HERSENACTIVITEIT
NA 20 MIN WANDELEN

Adaptations to Endurance and Strength Training

David C. Hughes,[1] Stian Ellefsen,[2,3] and Keith Baar[1]

[1]Department of Neurobiology, Physiology and Behavior, Functional Molecular Biology Laboratory, University of California Davis, Davis, California 95616

[2]Section of Sports Sciences, Lillehammer University College, 2604 Lillehammer, Norway

[3]Innlandet Hospital Trust, 2380 Brumunddal, Norway

Correspondence: kbaar@ucdavis.edu

- Als reactie op inspanning verandert de skeletspier
- Spieropbouw, stijfheid bindweefsel

- Toename van maximale hartminuutvolume
- Toename stofwisseling in skeletspier

Adaptatie

- Aanpassingen van het lichaam na sport en bewegen leiden niet alleen tot betere sport prestaties maar tot vertraging/uitstel/afstel van allerlei chronische aandoeningen

Adaptatie (2)

- Toename van aantal en grootte mitochondrieen
- Toename van kleine bloedvaten in spieren, hart en hersenen
- Sterke relatie met intensiteit; grootste toename bij hoge intensiteit bewegen

- Toename mitochondriele enzymen, ook van p53

p53

- Key player in substraat metabolisme en mitochondriele biogenese en eerst ontdekte tumor suppressor eiwit

- Generiek tumor suppressor eiwit

  -Apoptose

  -Angiogenese

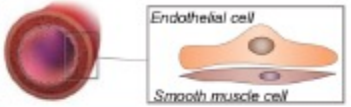
  -DNA repair

  -Cell senescence

  -Cell cycle arrest

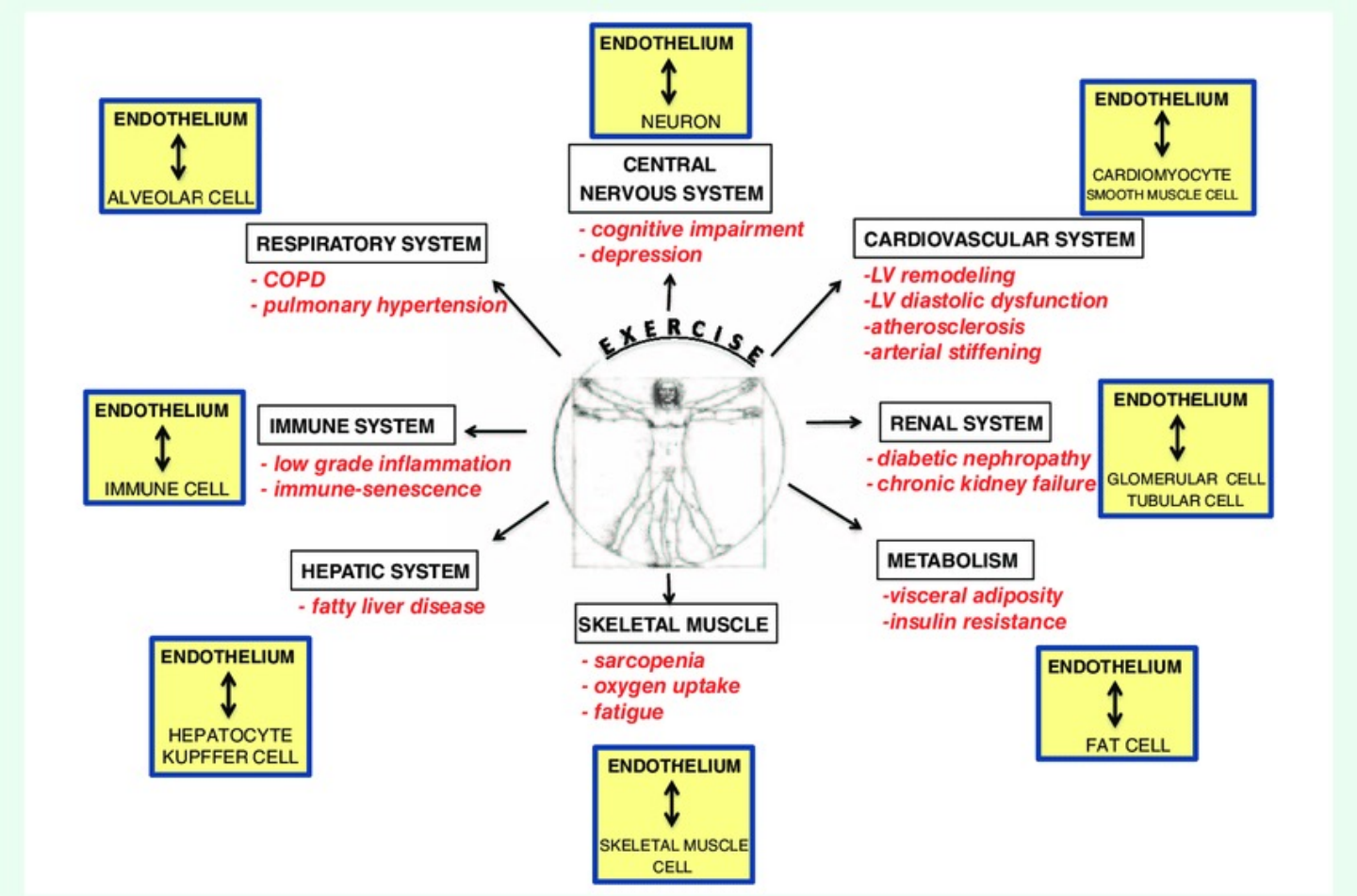


Myokines

	Mitochondrial	Skeletal Muscle	Cardiac Muscle	Conduit Arteries
				
Sedentary 	•↑ mitochondrial DNA deletions and mutations[71] •Electron transport chain abnormalities[72] •↑ mitochondrial fission[73] •↓ mitochondrial content[74] •↓ respiration[4]	•↑ IL-6 and CRP[80] •Activation of proteolytic systems[81] •Inactivation of the PI3K/Akt/mTOR pathway[82] •↓ lean muscle mass[83] •Greater proportion of hybrid fibers possibly due to dysregulation in MHC isoform expression[84]	•↑ AGE accumulation indicative of collagen cross-linking[87] •↑ Left ventricular stiffness[88] •β-adrenergic receptor desensitization resulting in impaired inotropic and chronotropic responses to adrenergic stimulation[89, 90] •↓ SERCA2a contributes to prolonged calcium transients[91]	•↓ sympathetic baroreflex sensitivity and ↑ sympathetic activation[94] •↑ NOS uncoupling, ↓ NO bioavailability, thereby ↑ oxidative stress[94] •Extracellular matrix remodeling through elastin degradation by MMPs and formation of AGEs[95] •Endothelial dysfunction[96]
Physical Activity 	•↑ mitochondrial protein turnover through degradation of damaged proteins and de novo synthesis of new functional proteins[75] •↑ expression of PGC-1α[76, 77] •↑ SIRT3 content[78] •↑ mitochondrial volume[79]	•↑ metabolic enzymes profile: citrate synthase, β-HAD, glycogen phosphorylase[85] •↓ catabolic mRNA expression (FOXO3a, MuRF-1, Atrogin-1, myostatin)[86] •↑ capillary-to-fiber ratio[85] •↑ insulin sensitivity[76]	•↑ SERCA2a mRNA & protein expression[92] •↑ phosphorylation of threonine-17 residue of phospholamban allowing for faster reuptake of cytoplasmic calcium[92] •↑ contractility and relaxation due to faster systolic rise and diastolic decay time of calcium[93] •↓ Left ventricular stiffness[88]	•Lower expression of the transcription factor p53 which is associated with senescence compared to sedentary counterparts[97] •Lower markers of senescence (p21 and p16)[97] •↓ expression of nitrotyrosine and NADPH oxidase (prooxidant)[96] •↑ expression of manganese SOD (antioxidant)[96]

Circulation 2019

Muscle organ crosstalk



The pleiotropy of exercise. Exercise training is the most potent medicine known to man.

Neurobiology of Exercise

Rod K. Dishman, Hans-Rudolf Berthoud,† Frank W. Booth,‡ Carl W. Cotman,§ V. Reggie Edgerton,¶ Monika R. Fleshner,‖ Simon C. Gandevia,** Fernando Gomez-Pinilla,¶ Benjamin N. Greenwood,‖ Charles H. Hillman,†† Arthur F. Kramer,†† Barry E. Levin,‡‡ Timothy H. Moran,§§ Amelia A. Russo-Neustadt,¶¶ John D. Salamone,‖‖ Jacqueline D. Van Hoomissen,*** Charles E. Wade,††† David A. York,† and Michael J. Zigmond‡‡‡*



- Synaptogenese
- BDNF
- Neurotrophines
- Angiogenese
- Neurotransmitters
- Telomeer lengte
- Up regulatie van genen betrokken bij plasticiteit
- Down regulatie genen geassocieerd met oxidatieve stress

Obesity, 2006

Slijtage vs adaptatie





Wat moet er gebeuren

- Maatschappij meer gericht op bewegen!
- Budget van ‘curatief’ naar preventief
- Meer bewegingsonderwijs lagere en middelbare scholen (grondmotorische vaardigheden)

- Meer kennis in geneeskunde over enorme effect bewegen / aerobe fitness
- Woon werkverkeer !

- Ziekenhuizen, huisartsen, we zetten life style op 1
  - kom op fiets of lopen (parkeren duurder)
  - trap in ziekenhuis nemen
  - geen pil maar aanmelden sport/wandelclub e.d.
  - verkoop je e-bike en scooter !

Fysieke inactiviteit

- Meest voorkomende risicofactor
- Grootste qua effect
- Pleiotroop
- En ‘leukste’ om te veranderen

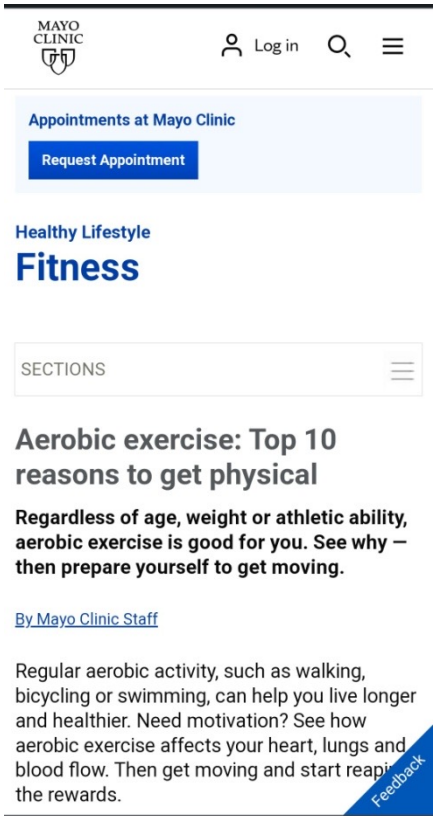
- En life style en shared decision making houdt wat mij betreft ook in dat we laten zien wat (beperkte) effect van veel medicatie is



AHA SCIENTIFIC STATEMENT

Importance of Assessing Cardiorespiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign

A Scientific Statement From the American Heart Association


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Healthy Lifestyle

Fitness

SECTIONS

Aerobic exercise: Top 10 reasons to get physical

Regardless of age, weight or athletic ability, aerobic exercise is good for you. See why — then prepare yourself to get moving.

By Mayo Clinic Staff

Regular aerobic activity, such as walking, bicycling or swimming, can help you live longer and healthier. Need motivation? See how aerobic exercise affects your heart, lungs and blood flow. Then get moving and start reapi the rewards.

Feedback

Circulation 2016

conclusie

- Iedereen, elk orgaan en elke parameter is trainbaar en verbeterbaar op elke leeftijd

Bewegen een Hoofdzaak

Contact

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Volgen