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BERN UNIVERSITY HOSPITAL

Symposium für Ernährungsfachleute
10. September 2013, Kultur-Casino Bern

Sport und Ernährung – Ein fittes Gespann

swissmilk

Wie gesund sind Sport und Bewegung?

Matthias Wilhelm
Kardiovaskuläre Prävention,
Rehabilitation & Sportmedizin
Schweizer Herz- und Gefässzentrum

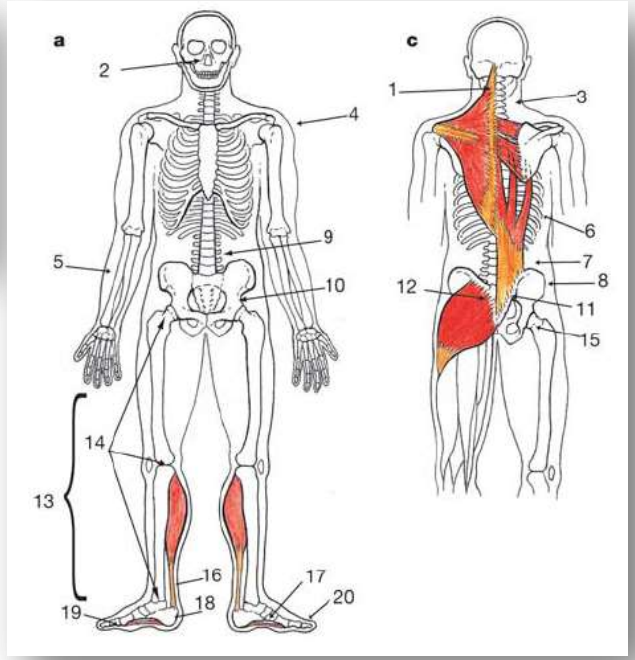
Endurance running and the evolution of *Homo*

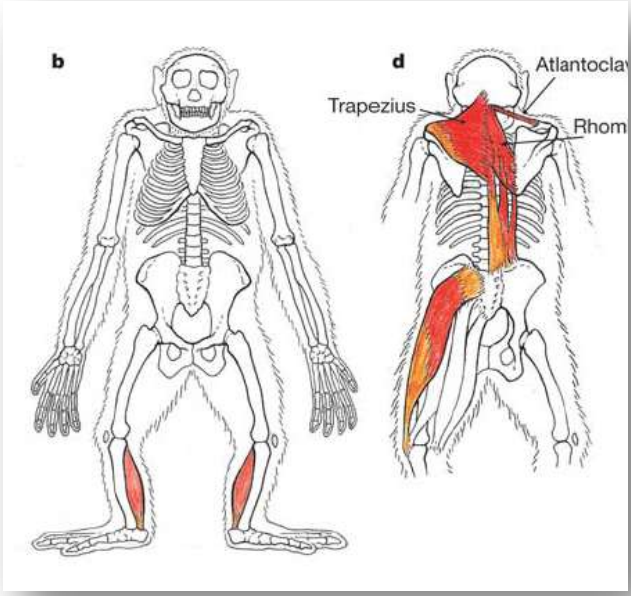
Dennis M. Bramble[1] **& Daniel E. Lieberman**[2]

[1]*Department of Biology, University of Utah, Salt Lake City, Utah 84112, USA*
[2]*Peabody Museum, Harvard University, Cambridge, Massachusetts 02138, USA*

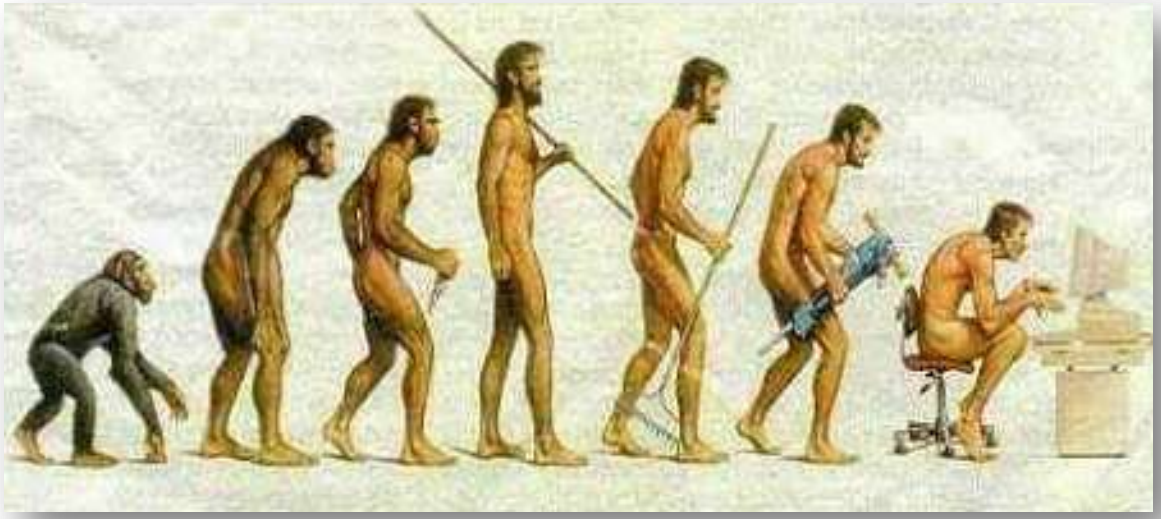
NATURE | VOL 432 | 18 NOVEMBER 2004 |

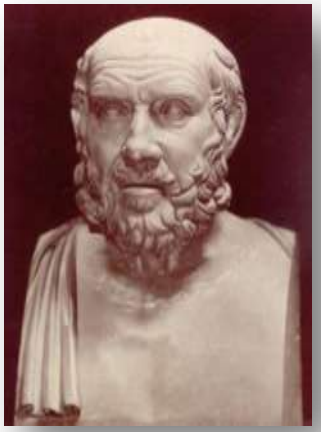
*"Striding **bipedalism** is a key derived **behaviour of hominids** that possibly originated soon after the divergence of the chimpanzee and human lineages.*
*The fossil evidence of these features suggests that **endurance running** is a derived capability of the genus **Homo**, originating about 2 million years ago, and **may have been instrumental in the evolution of the human body form.**"*



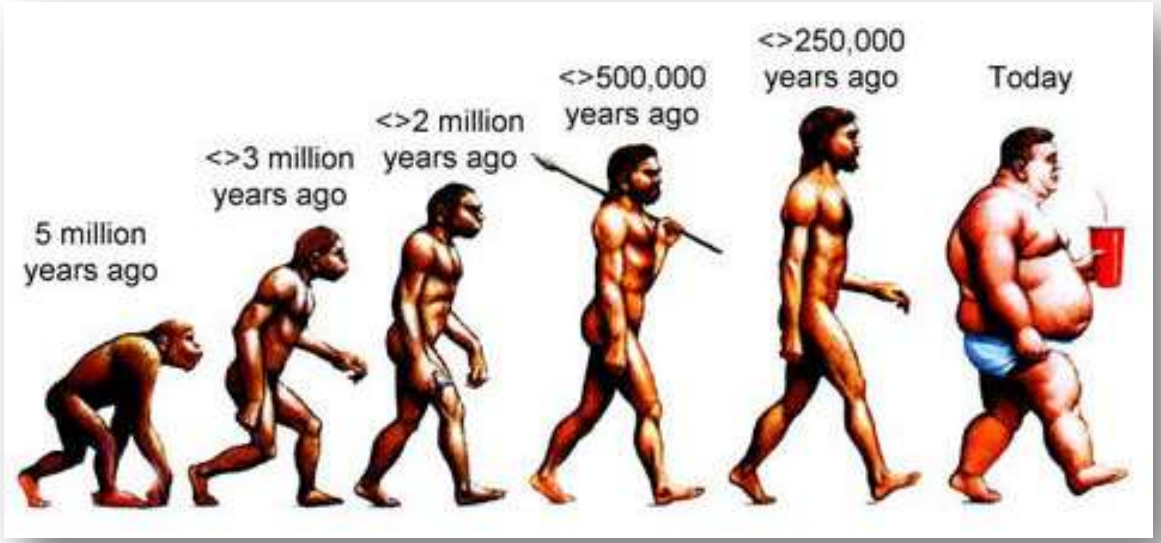


Evolution





Hippokrates 460-370 v. Chr.



«Wenn wir jedem Individuum das richtige Mass an ***Nahrung und Bewegung*** *zukommen lassen könnten, hätten wir den sichersten Weg zur Gesundheit gefunden.»*

Studie mit dem Personal von Doppeldeckerbussen in London:
Die Mortalität von Kontrolleuren war 50% niedriger im Vergleich zu Chauffeuren.

Morris, Lancet 1953

The New England
Journal of Medicine

VOLUME 346 MARCH 14, 2002 NUMBER 11

EXERCISE CAPACITY AND MORTALITY AMONG MEN REFERRED FOR EXERCISE TESTING

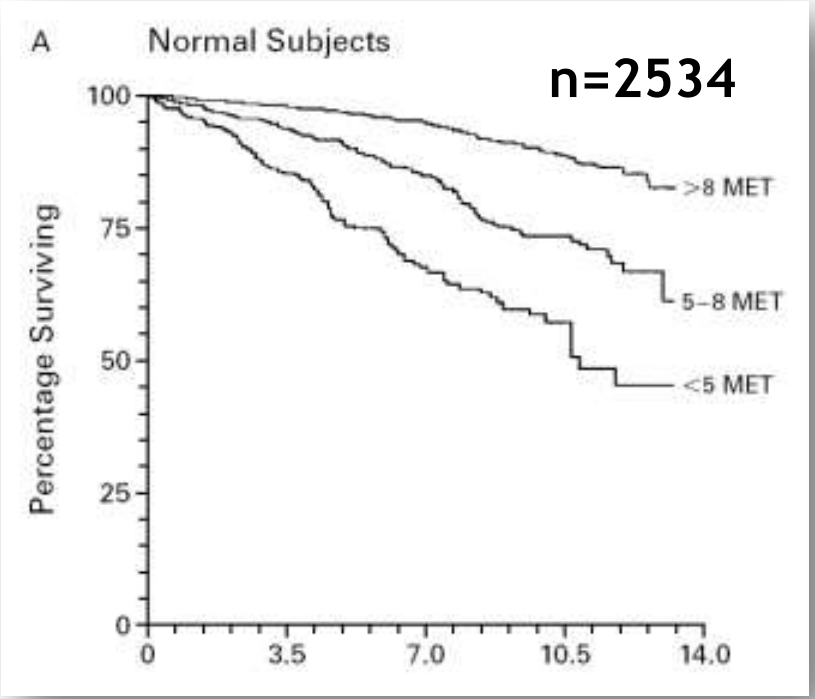
JONATHAN MYERS, PH.D., MANISH PRAKASH, M.D., VICTOR FROELICHER, M.D., DAT DO, M.D., SARA PARTINGTON, B.SC., AND J. EDWIN ATWOOD, M.D.

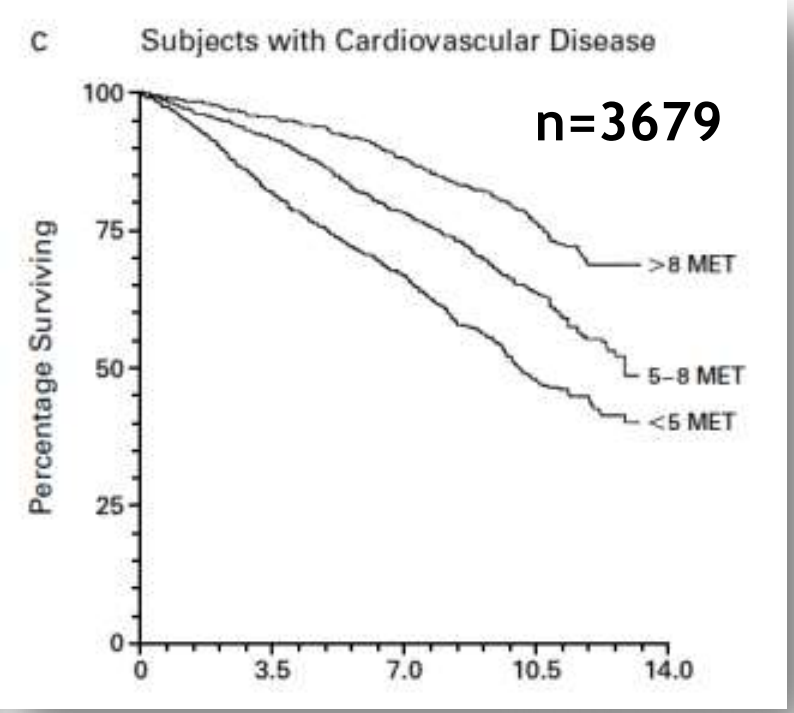
6213 Männer,
59±11 Jahre

klinische Indikation zum Belastungstest

6.2±3.7 Jahre Follow-Up

Wer fit ist lebt länger.





Lifestyle - clustering of risk factors - atherosclerosis

Age

Gender

Family history

Sedentary lifestyle

Depression

Dietary fat & sugar

Smoking

Obesity

Emotional stress

Hypertension

Inflammation

Dyslipoproteinaemia

Type II Diabetes

Lifestyle - clustering of risk factors - atherosclerosis

Age

Gender

Family history

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Lifestyle - clustering of risk factors - atherosclerosis

Age

Gender

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Dietary fat & sugar

Smoking

Obesity

Emotional stress

Hypertension

Inflammation

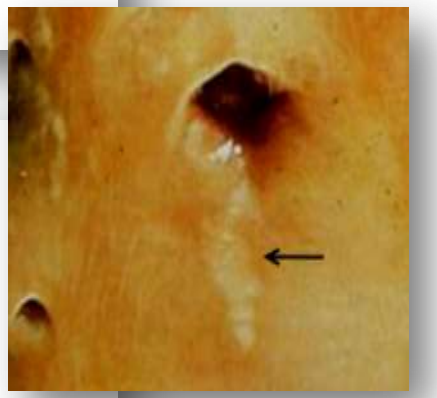
Dyslipoproteinaemia

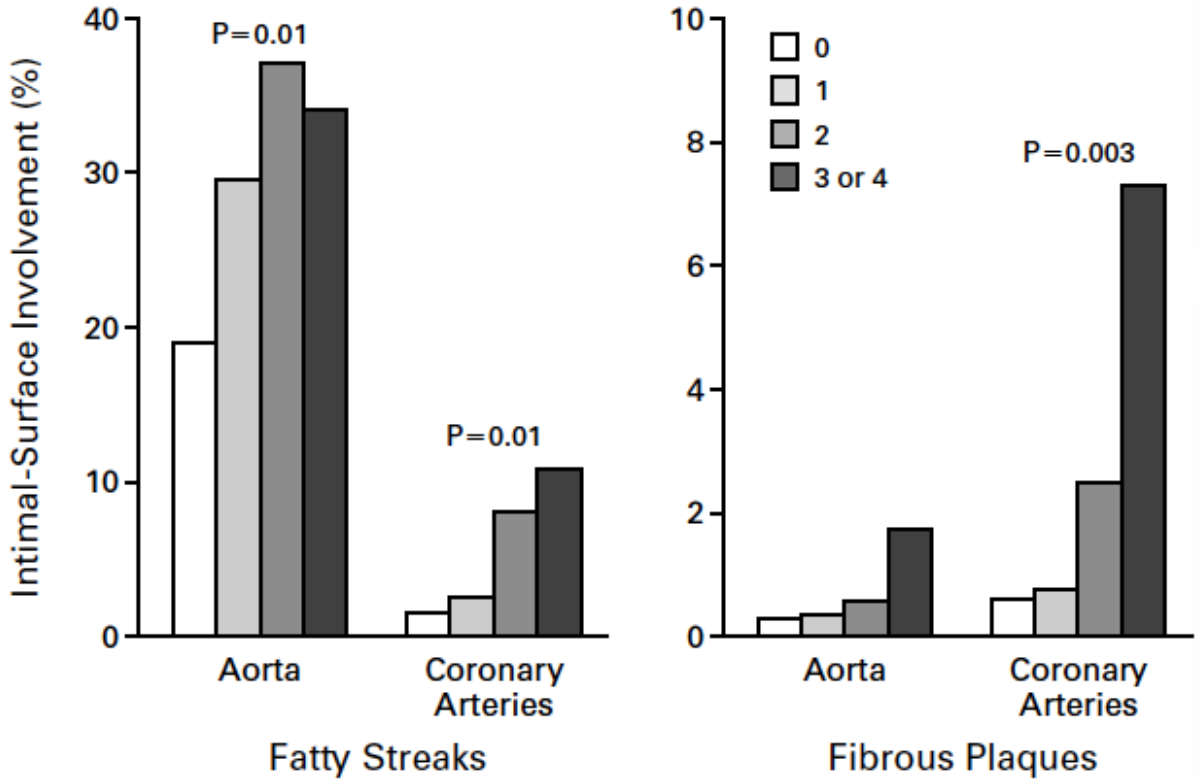
Type II Diabetes

The New England Journal of Medicine

ASSOCIATION BETWEEN MULTIPLE CARDIOVASCULAR RISK FACTORS AND ATHEROSCLEROSIS IN CHILDREN AND YOUNG ADULTS

GERALD S. BERENSON, M.D., SATHANUR R. SRINIVASAN, PH.D., WEIHANG BAO, PH.D., WILLIAM P. NEWMAN III, M.D., RICHARD E. TRACY, M.D., PH.D., AND WENDY A. WATTIGNEY, M.S., FOR THE BOGALUSA HEART STUDY





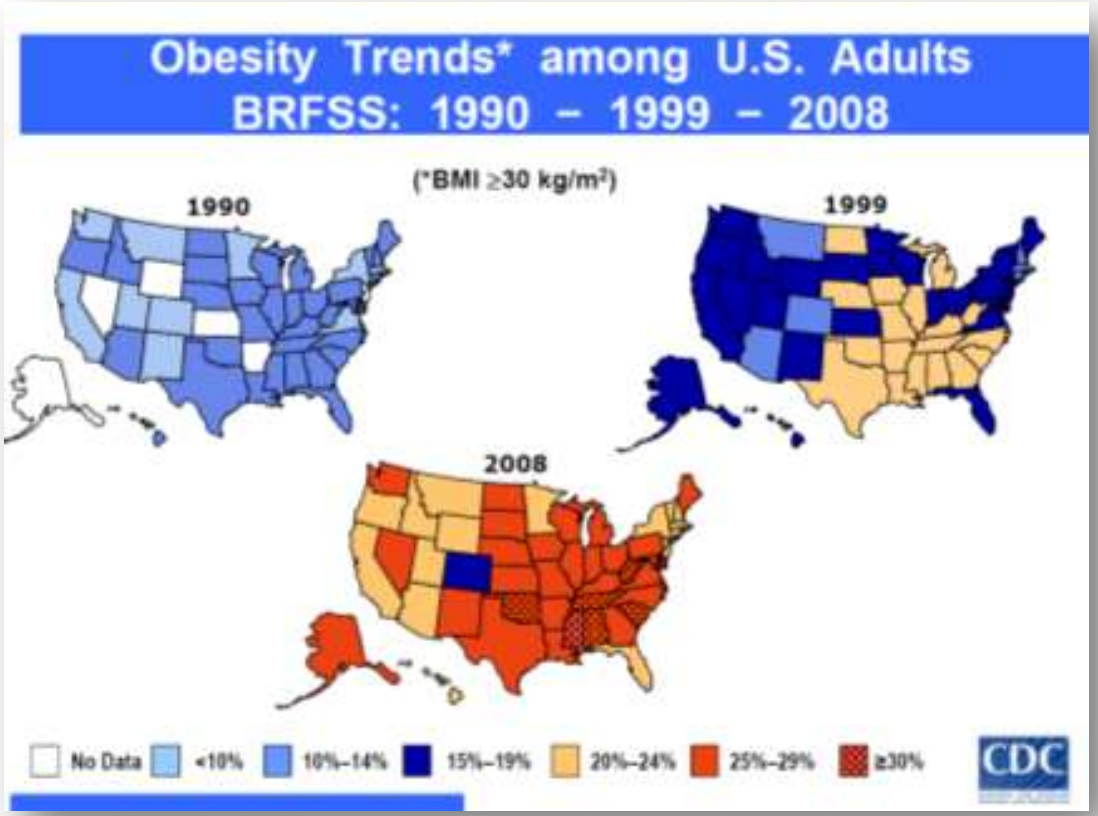
RISK-FACTOR VARIABLE

Body-mass index
Systolic blood pressure
Diastolic blood pressure
Total cholesterol
LDL cholesterol
HDL cholesterol
Triglycerides

Figure 3. The Effect of Multiple Risk Factors on the Extent of Atherosclerosis in the Aorta and Coronary Arteries in Children and Young Adults.

N Engl J Med 1998;338:1650-6


Give our best to your family.
You can count on nothing but the best from McDonald's® restaurants. Pure 100% beef that's probably even leaner than the kind you serve at home.
Perfect fries. Pipin' hot pies. Breakfast dishes that are really delicious. And fish that never tastes "fishy"... just good.
Those are but a few of the quality dishes we serve with pride at McDonald's.®
But what we're always proudest to serve is you.
We do it all for you
McDonald's


Obesity Trends* among U.S. Adults
BRFSS: 1990 – 1999 – 2008
(*BMI ≥30 kg/m²)
1990
1999
2008
No Data
<10%
10%–14%
15%–19%
20%–24%
25%–29%
≥30%
CDC

≠

High prevalence of overweight and obesity in 11–15-year-old children from Sicily

Roberto Baratta [1], Claudia Degano [1], Daniela Leonardi, Riccardo Vigneri, Lucia Frittitta*

Overweight and Obesity
40% at 11 years, 25% at 15 years

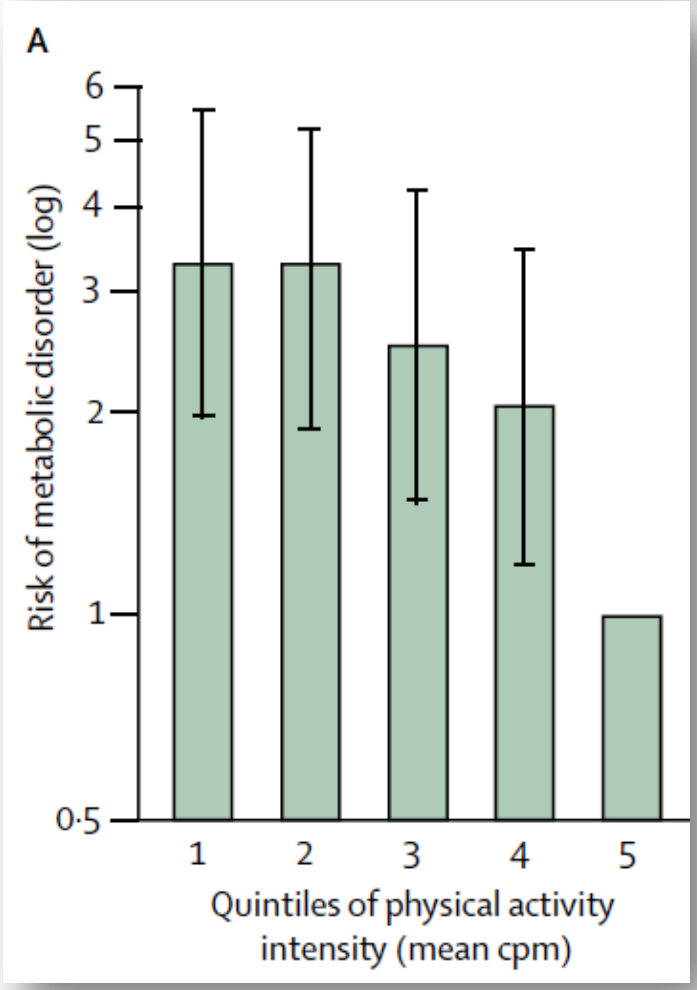
Table 1 Median BMI values in Sicily, by gender and age, compared to values in Southern Italy, Central–Northern (C-N) Italy and the USA (CDC 2000)

	Age (years)	Sicily		Southern Italy	C-N Italy	USA
		Cases (*n*)	Median	Median	Median	Median
Males	11	1020	19.4	18.7	18.7	17.2
	12	4714	19.7	19.4	19.5	17.8
	13	8055	20.0	20.2	20.2	18.5
	14	7012	20.3	20.9	20.8	19.2
	15	3318	20.6	21.5	21.2	19.9
Females	11	1045	19.3	19.0	18.8	17.5
	12	5085	19.5	19.8	19.6	18.1
	13	8176	19.8	20.4	20.2	18.7
	14	7219	20.5	21.0	20.6	19.3
	15	3253	21.0	21.3	20.8	19.9

Nutrition, Metabolism & Cardiovascular Diseases (2006) 16, 249–255

Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study)

Lars Bo Andersen, Maarike Harro*, Luis B Sardinha, Karsten Froberg, Ulf Ekelund, Søren Brage, Sigmund Alfred Anderssen



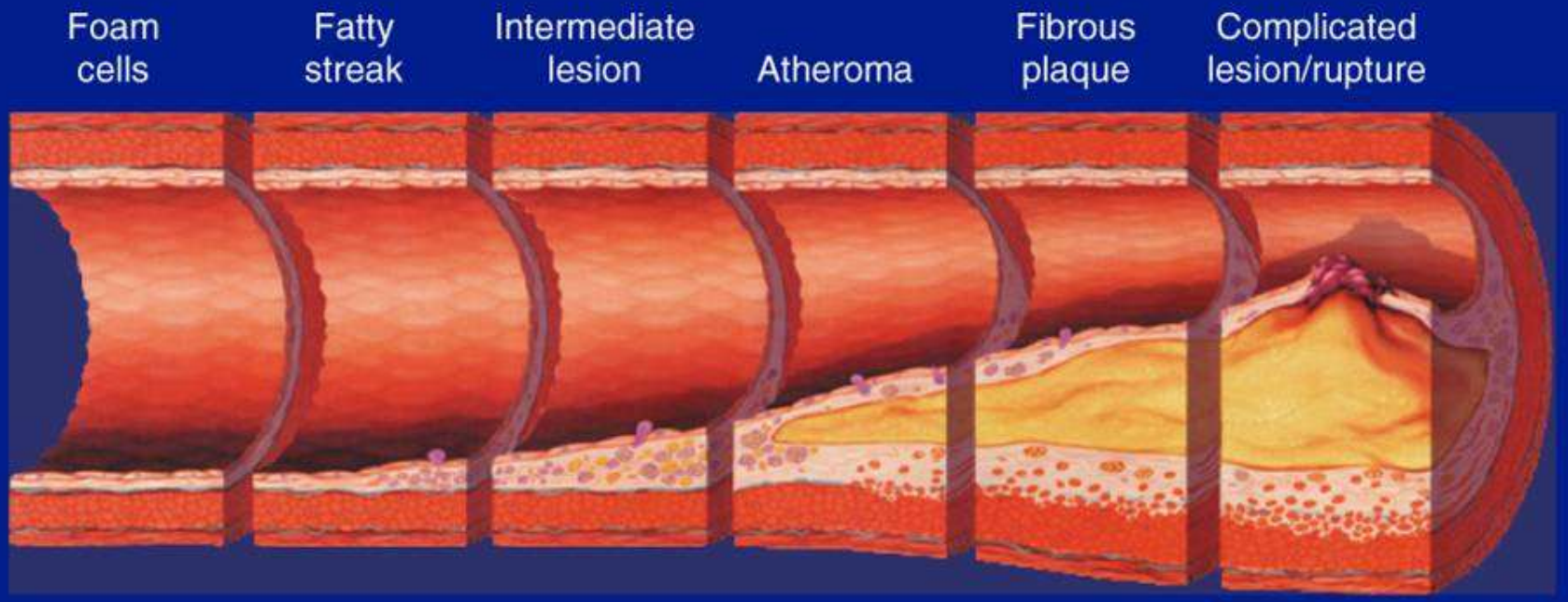
Cross-sectional study of 1732 randomly selected 9-year-old and 15-year-old school children from Denmark, Estonia, and Portugal.

Composite risk factor score (mean of *Z scores):*
- **Systolic blood pressure**
- **Triglyceride,**
- **Total cholesterol/HDL ratio,**
- **Insulin resistance,**
- **Sum of four skinfolds,**
- **Aerobic fitness**

Individuals with a risk score above 1 SD of the composite variable were defined as being at risk. Physical activity was assessed by accelerometry.

Lancet 2006; 368: 299–304

Atherosclerosis timeline



From first decade	From third decade	From fourth decade	
Growth mainly by lipid accumulation		Smooth muscle and collagen	Thrombosis, hematoma

Pepine CJ. *Am J Cardiol.* 1998;82(suppl 10A):23S-27S.

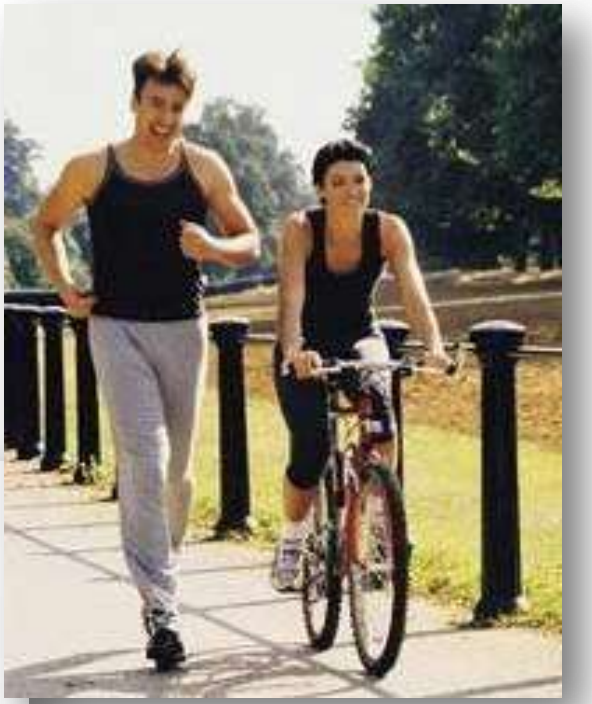
European Heart Journal (2013) 34, 1790–1799
doi:10.1093/eurheartj/eht111

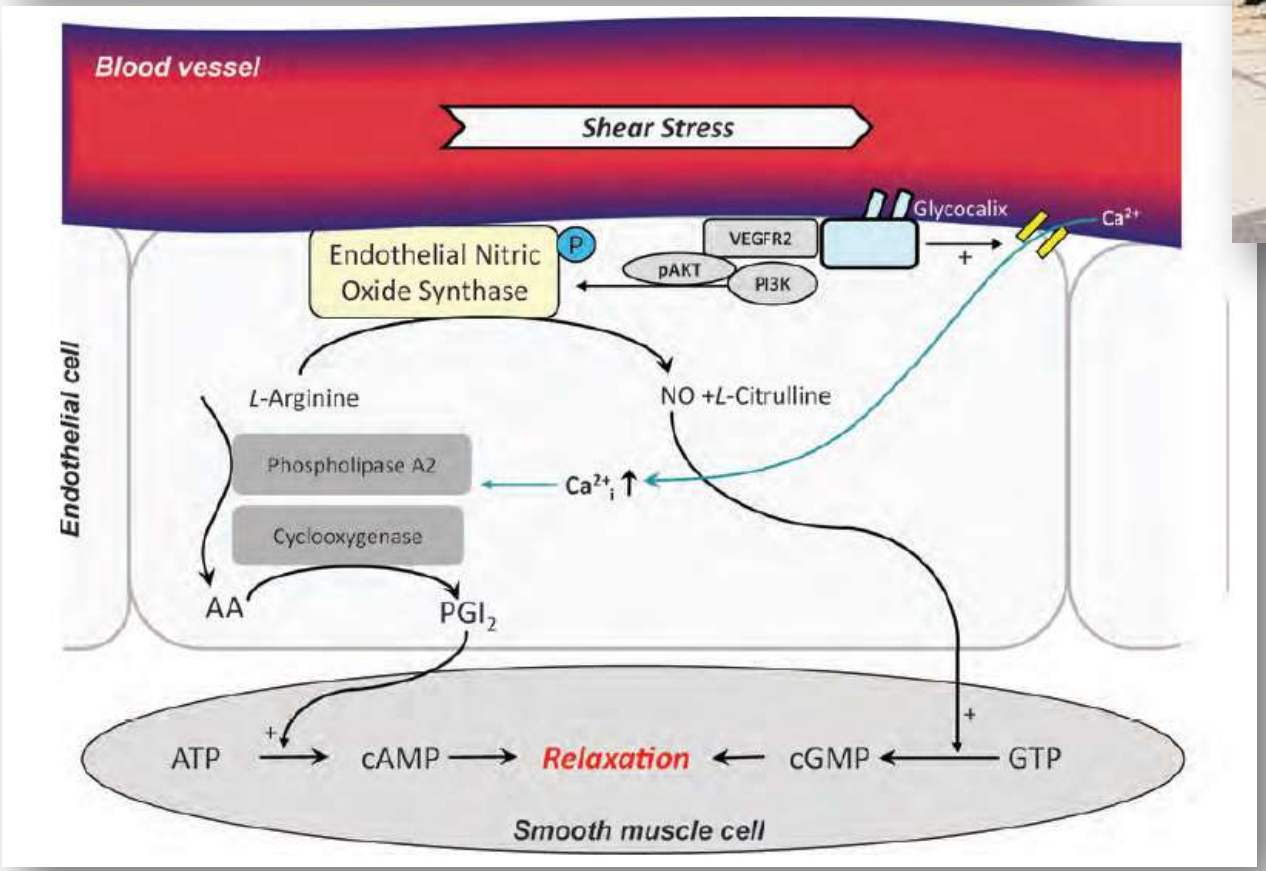
REVIEW

Novel therapeutic concepts

Role of exercise in the prevention of cardiovascular disease: results, mechanisms, and new perspectives

Gerhard Schuler[1]*, Volker Adams[1], and Yoichi Goto[2]

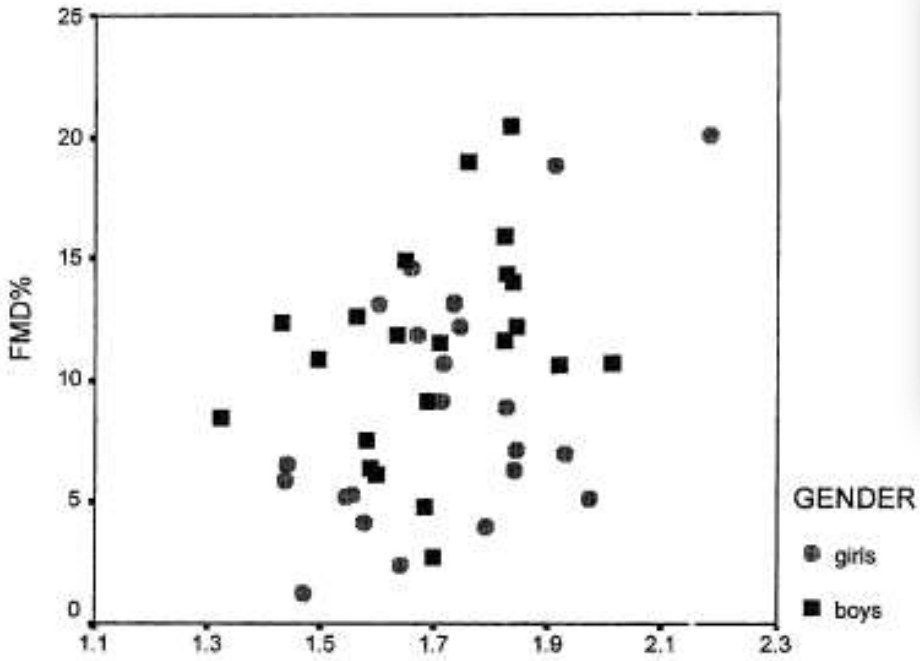




Correlation of habitual physical activity levels with flow-mediated dilation of the brachial artery in 5–10 year old children

Rebecca A. Abbott [a], Margo A. Harkness [b], Peter S.W. Davies [c,*]

[a] *School of Human Movement Studies, Faculty of Health, Queensland University of Technology, Herston, Brisbane, Qld 4059, Australia*
[b] *Centre for Medical and Health Physics, Faculty of Science, Queensland University of Technology, Gardens Point, Brisbane, Qld 4000, Australia*
[c] *Children's Nutrition Research Centre, Department of Pediatrics and Child Health, Royal Children's Hospital, University of Queensland, Herston, Brisbane, Qld 4029, Australia*



Physical Activity Level

* Grouped correlation: r = 0.39, p = 0.007

Atherosclerosis 160 (2002) 233–239

Journal of the American College of Cardiology
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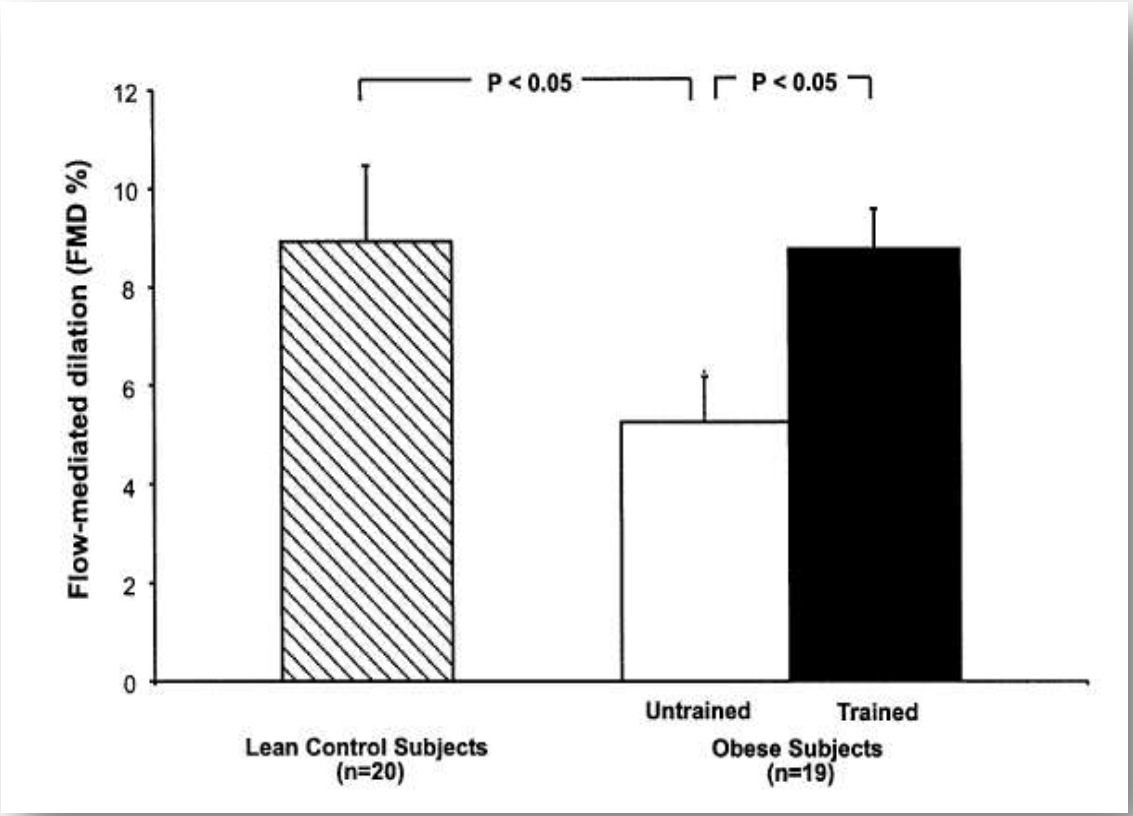
Published by Elsevier Inc.

Vol. 43, No. 10, 2004
ISSN 0735-1097/04/$30.00
doi:10.1016/j.jacc.2004.01.032

Exercise Training Normalizes Vascular Dysfunction and Improves Central Adiposity in Obese Adolescents

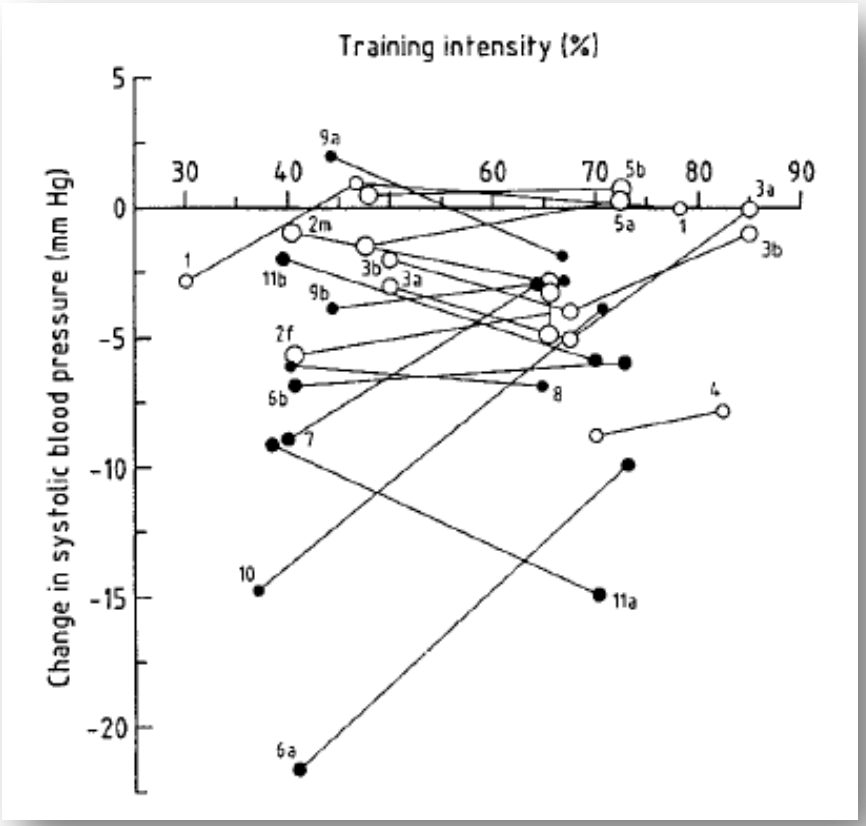
Katie Watts, BSc(Hons),* Petra Beye, MD,† Aris Siafarikas, MD,† Elizabeth A. Davis, FRACP,†‡
Timothy W. Jones, FRACP,†‡ Gerard O'Driscoll, FRACP,*§ Daniel J. Green, PhD*§
Crawley, Subiaco, and Perth, Western Australia

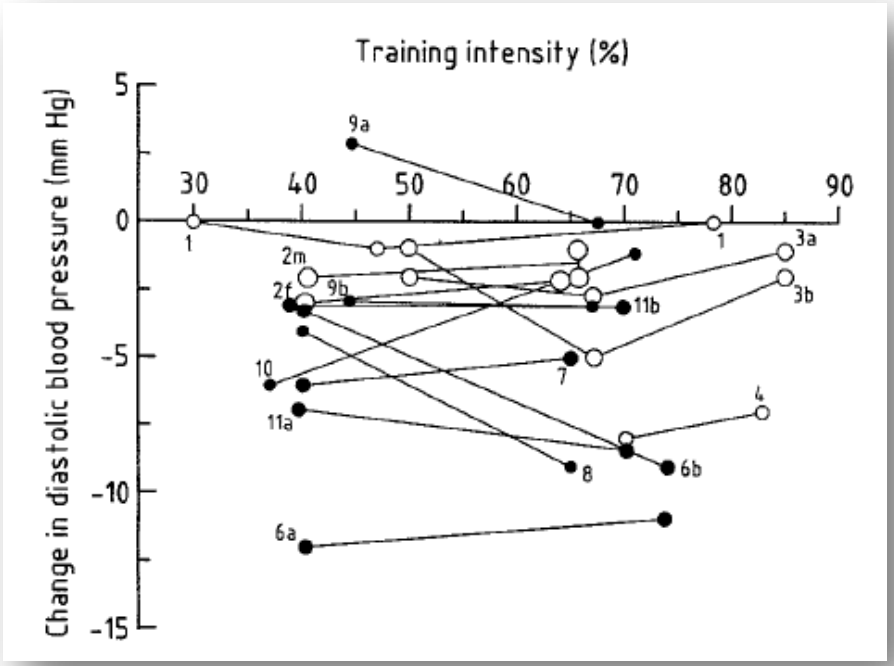


- 19 obese subjects
- age 14.3±1.5 years
- cross-over design
- 8 weeks circuit training
  - 3x/week à 1 hour
  - cycling (65-85 % HRmax)
  - strength (55-70% max)

Exercise characteristics and the blood pressure response to dynamic physical training

ROBERT H. FAGARD



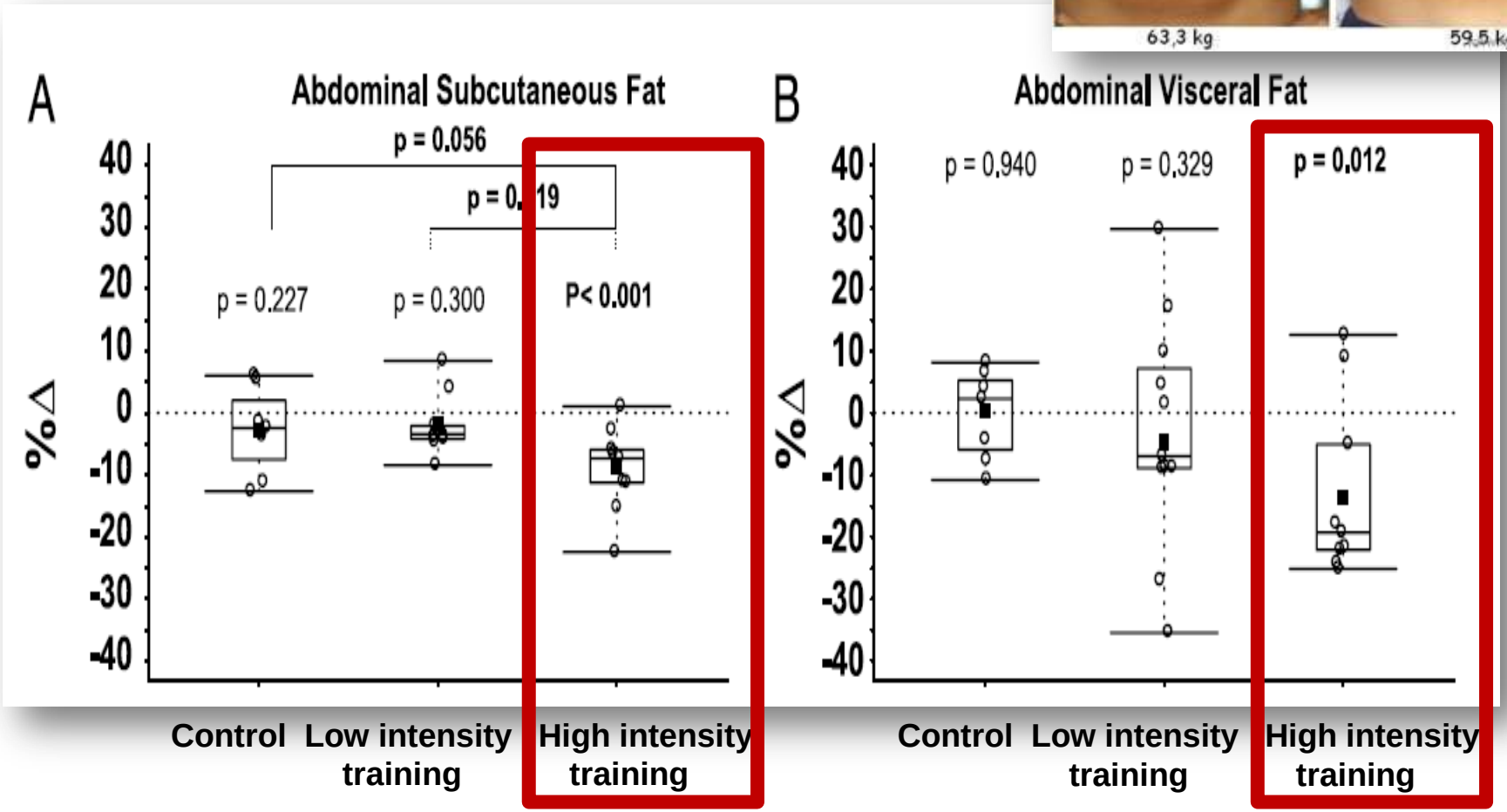


*Med. Sci. Sports Exerc. 2001;*33:S484–S492

Effect of Exercise Training Intensity on Abdominal Visceral Fat and Body Composition

BRIAN A. IRVING[1,5], CHRISTOPHER K. DAVIS[1,3], DAVID W. BROCK[1,5], JUDY Y. WELTMAN[4], DAMON SWIFT[1], EUGENE J. BARRETT[2,4], GLENN A. GAESSER[1], and ARTHUR WELTMAN[1,2,4]

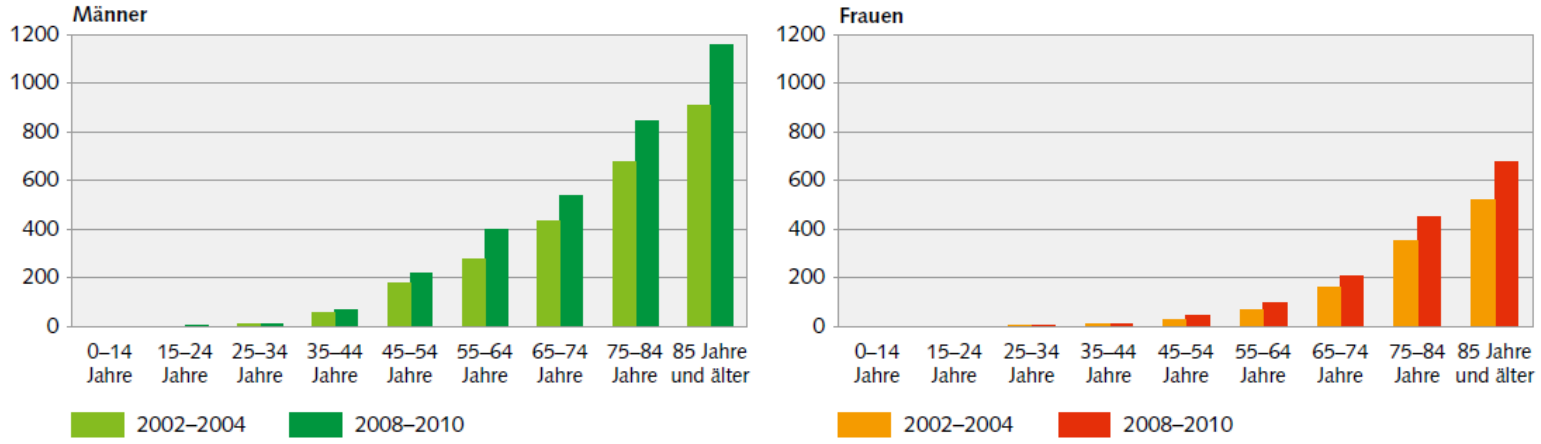
Med. Sci. Sports Exerc., Vol. 40, No. 11, pp. 1863–1872, 2008.



Wegen akutem Myokardinfarkt hospitalisierte Personen

Rate pro 100'000 Einwohnerinnen und Einwohner

G 4.20

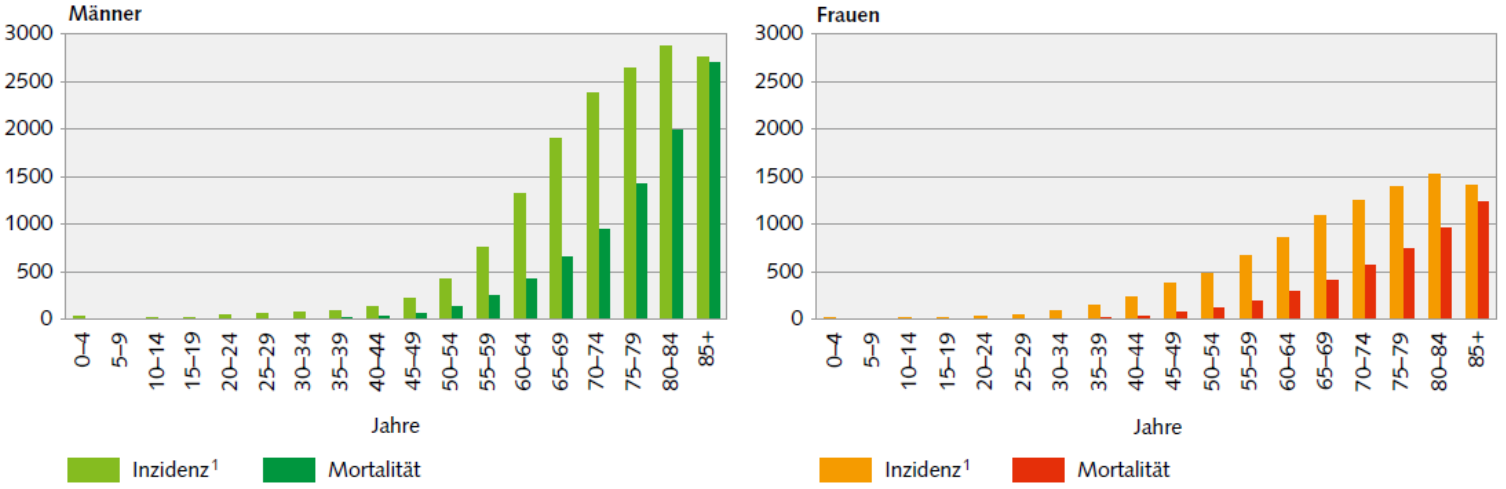


Quelle: BFS, MS

Krebs (Total), 2005–2009

Rate pro 100'000 Einwohnerinnen und Einwohner

G 4.30

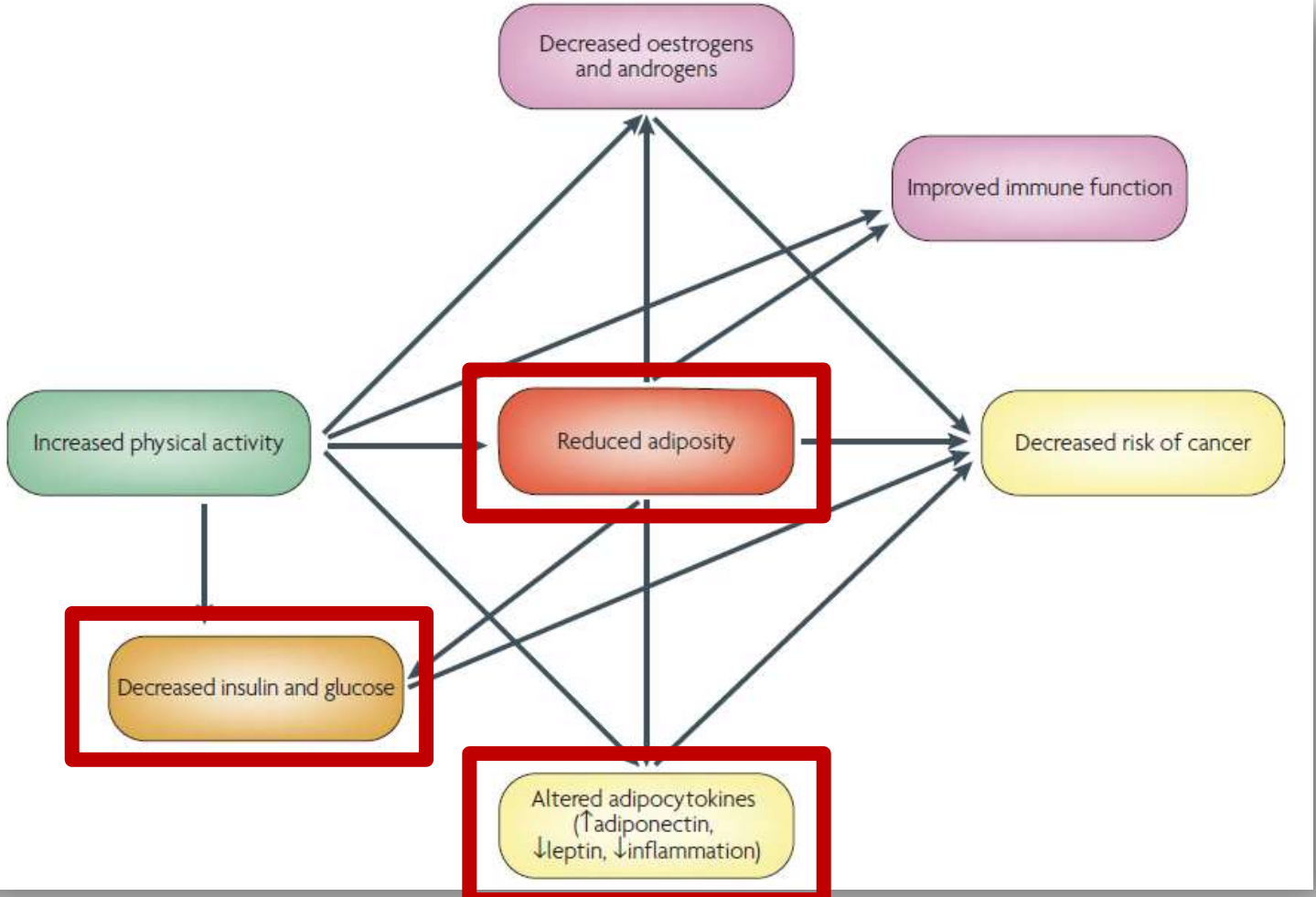


[1] Neue Fälle geschätzt aufgrund der Daten der Krebsregister

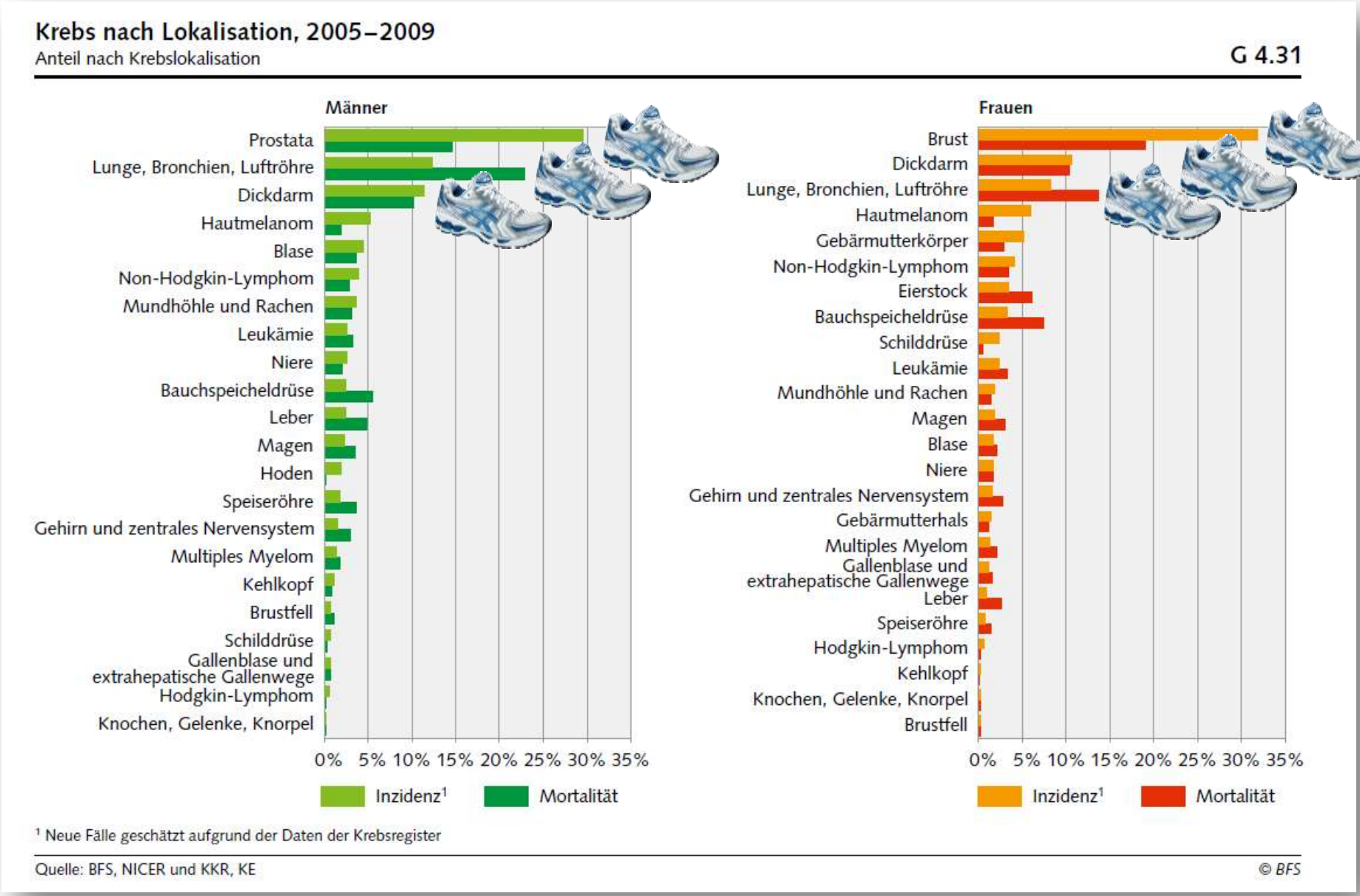
Quelle: BFS, NICER und KKR, KE

Mechanisms linking physical activity with cancer

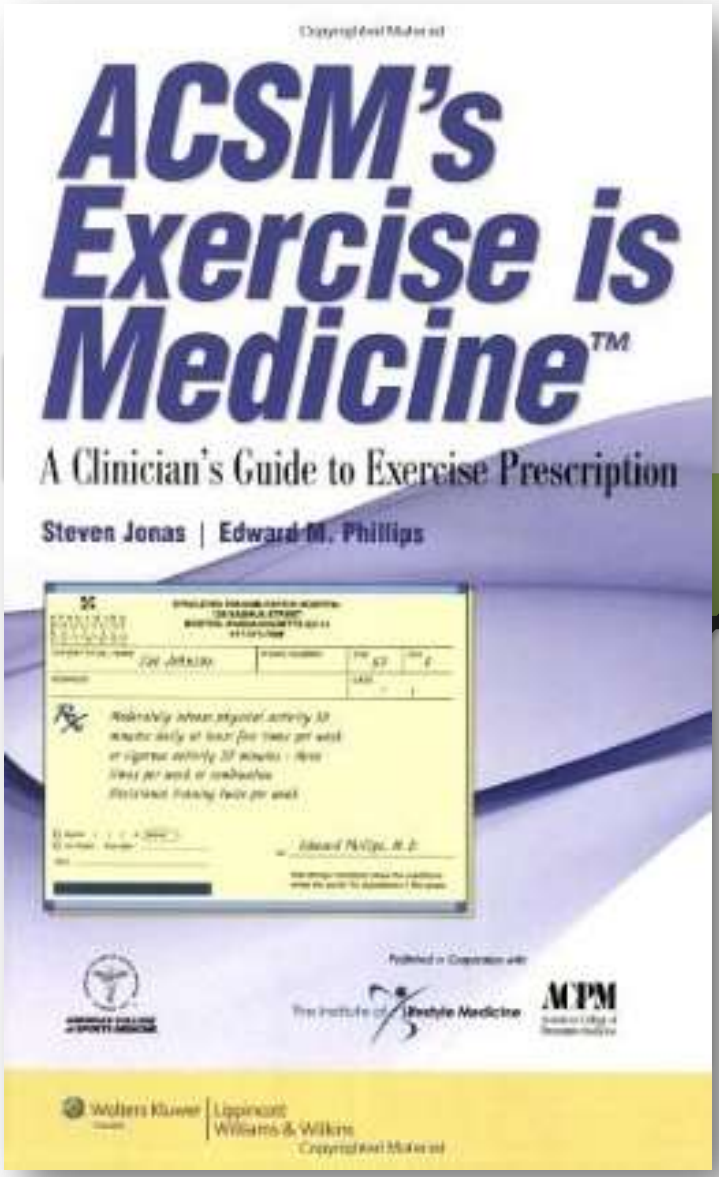
Anne McTiernan

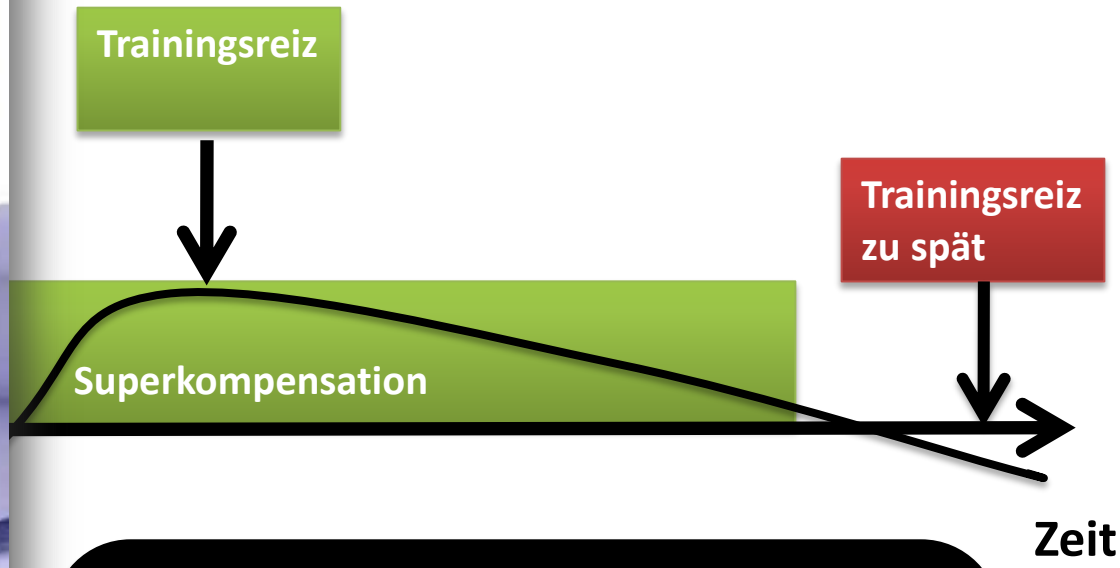


Positiver Effekt von Sport bei Krebserkrankungen



Grundlage Training und Leistungssteigerung





FITT

F – Frequency (how often?)

I – Intensity (how hard?)

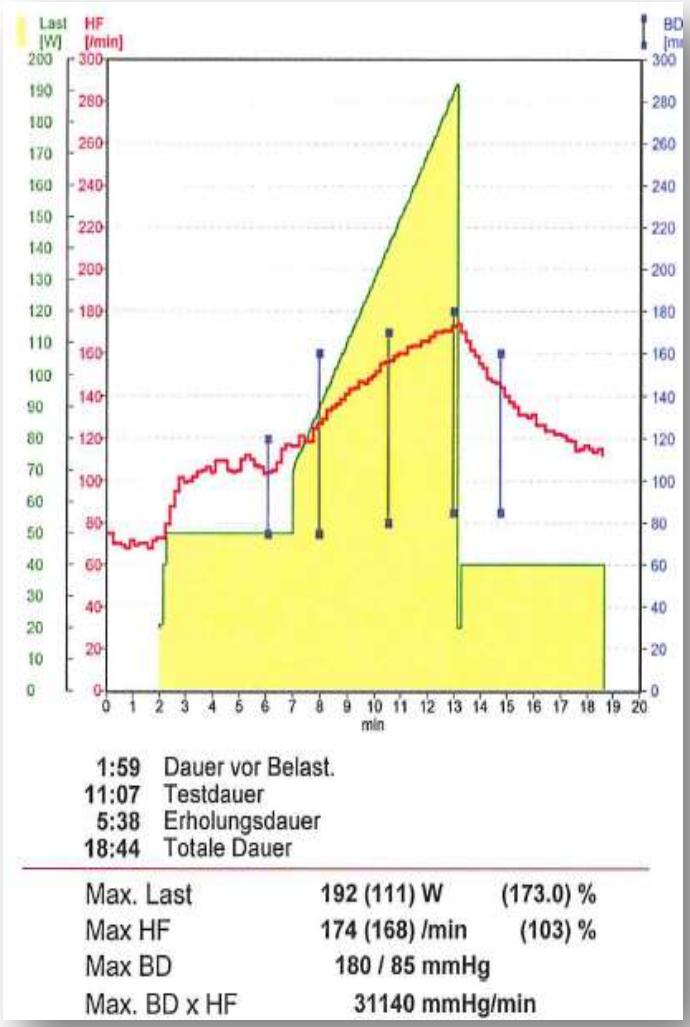
T – Time (how long?)

T – Type (what type?)

ACSM Guidelines for Exercise Testing and Prescription, 2010

Definition of training zones

Heart rate and rate of perceived exertion



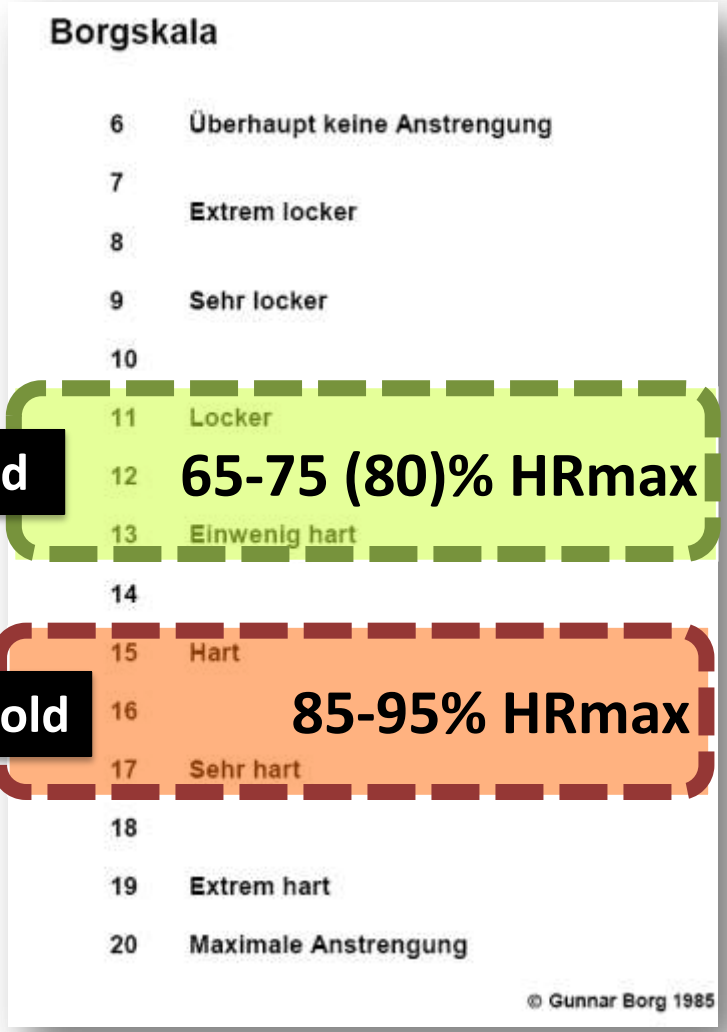
Zone I
«light PA»

Aerobic threshold

Zone II
«moderate PA»

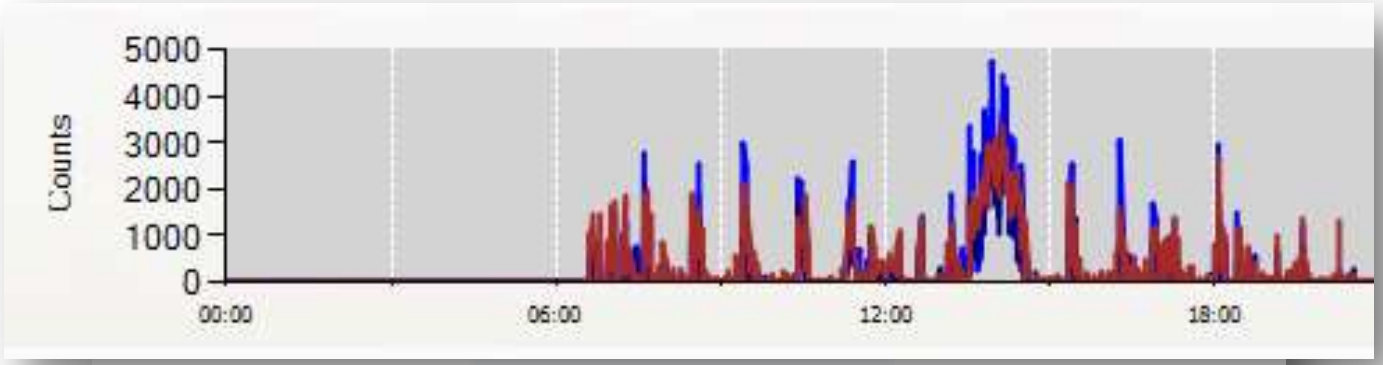
Anaerobic threshold

Zone III
«vigorous PA»



Accelerometry with Actigraph® (8 days):

- **Total PA time**
- **Moderate-to-Vigorous PA (3000-5200 cpm)**
- **Vigorous PA (>5200 cpm)**



Model 1
moderate to vigorous PA

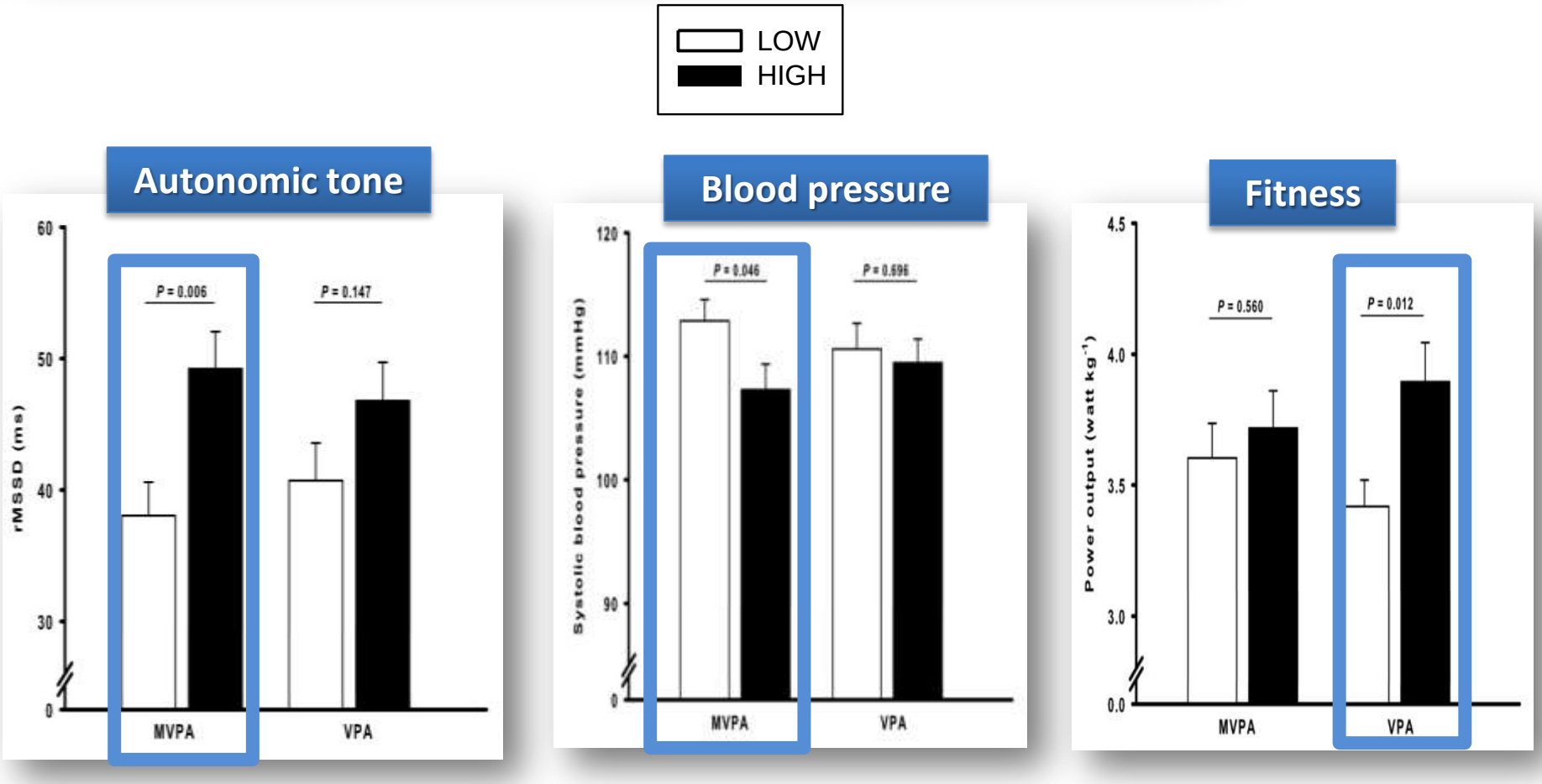
dichtomized

Model 2
Vigorous PA

LOW **HIGH** **LOW** **HIGH**

Physical activity intensity and surrogate markers for cardiovascular health in adolescents

Thomas Radtke · Susi Kriemler · Prisca Eser · Hugo Saner · Matthias Wilhelm



Eur J Appl Physiol 2012; DOI 10.1007/s00421-012-2542-2

EVIDENCE BASED PHYSICAL ACTIVITY FOR SCHOOL-AGE YOUTH

William B. Strong, MD,* Robert M. Malina, PhD,* Cameron J. R. Blimkie, PhD, Stephen R. Daniels, MD, PhD, Rodney K. Dishman, PhD, Bernard Gutin, PhD, Albert C. Hergenroeder, MD, Aviva Must, PhD, Patricia A. Nixon, PhD, James M. Pivarnik, PhD, Thomas Rowland, MD, Stewart Trost, PhD, and François Trudeau, PhD

60 Minuten pro Tag

- **Moderate bis anstrengende Intensität**
- **Dauer ≥ 10 Minuten**

J Pediatr 2005;146:732-7

3x pro Woche

- **Intensive Aktivitäten**

WHO Global recommendations on PA and health

European Heart Journal (2012) 33, 1635–1701
doi:10.1093/eurheartj/ehs092

JOINT ESC GUIDELINES

European Guidelines on cardiovascular disease prevention in clinical practice (version 2012)

The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts)

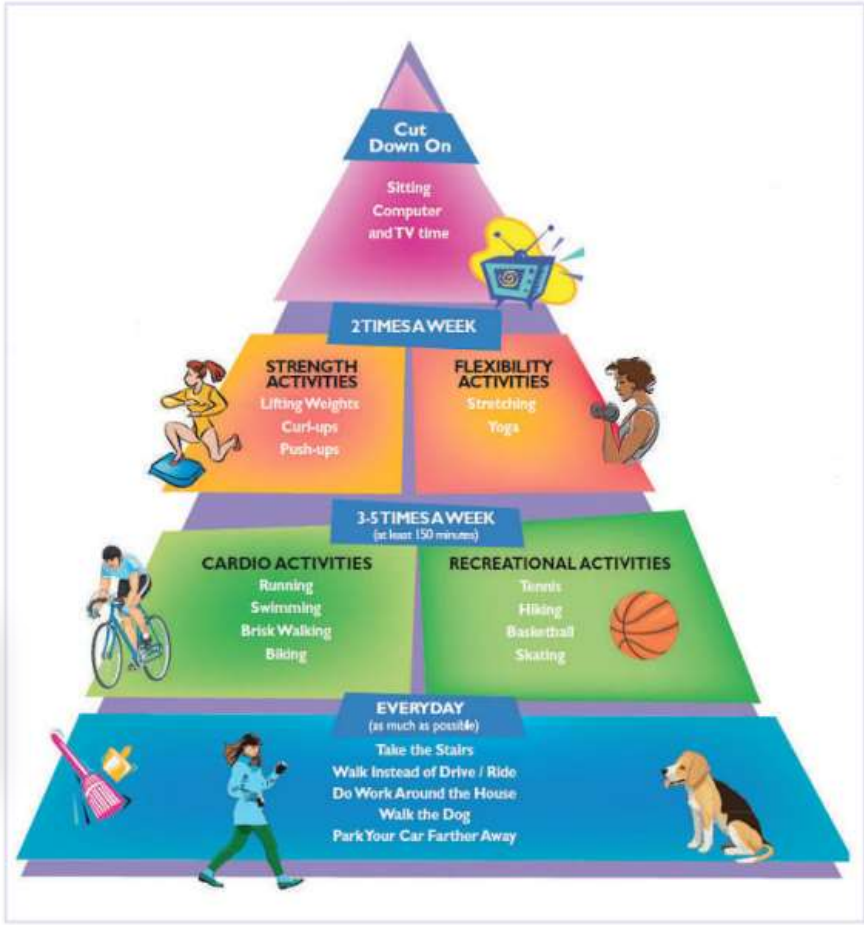
Recommendations regarding physical activity

Recommendations	Class[a]	Level[b]	GRADE	Ref[c]
Healthy adults of all ages should spend 2.5–5 h a week on physical activity or aerobic exercise training of at least moderate intensity, or 1–2.5 h a week on vigorous intense exercise. Sedentary subjects should be strongly encouraged to start light-intensity exercise programmes.	I	A	Strong	305–308
Physical activity/aerobic exercise training should be performed in multiple bouts each lasting ≥10 min and evenly spread throughout the week, i.e. on 4–5 days a week.	IIa	A	Strong	305–308
Patients with previous acute myocardial infarction, CABG, PCI, stable angina pectoris, or stable chronic heart failure should undergo moderate-to-vigorous intensity aerobic exercise training ≥3 times a week and 30 min per session. Sedentary patients should be strongly encouraged to start light-intensity exercise programmes after adequate exercise-related risk stratification.	I	A	Strong	309, 310

“Activity pyramid”

different views

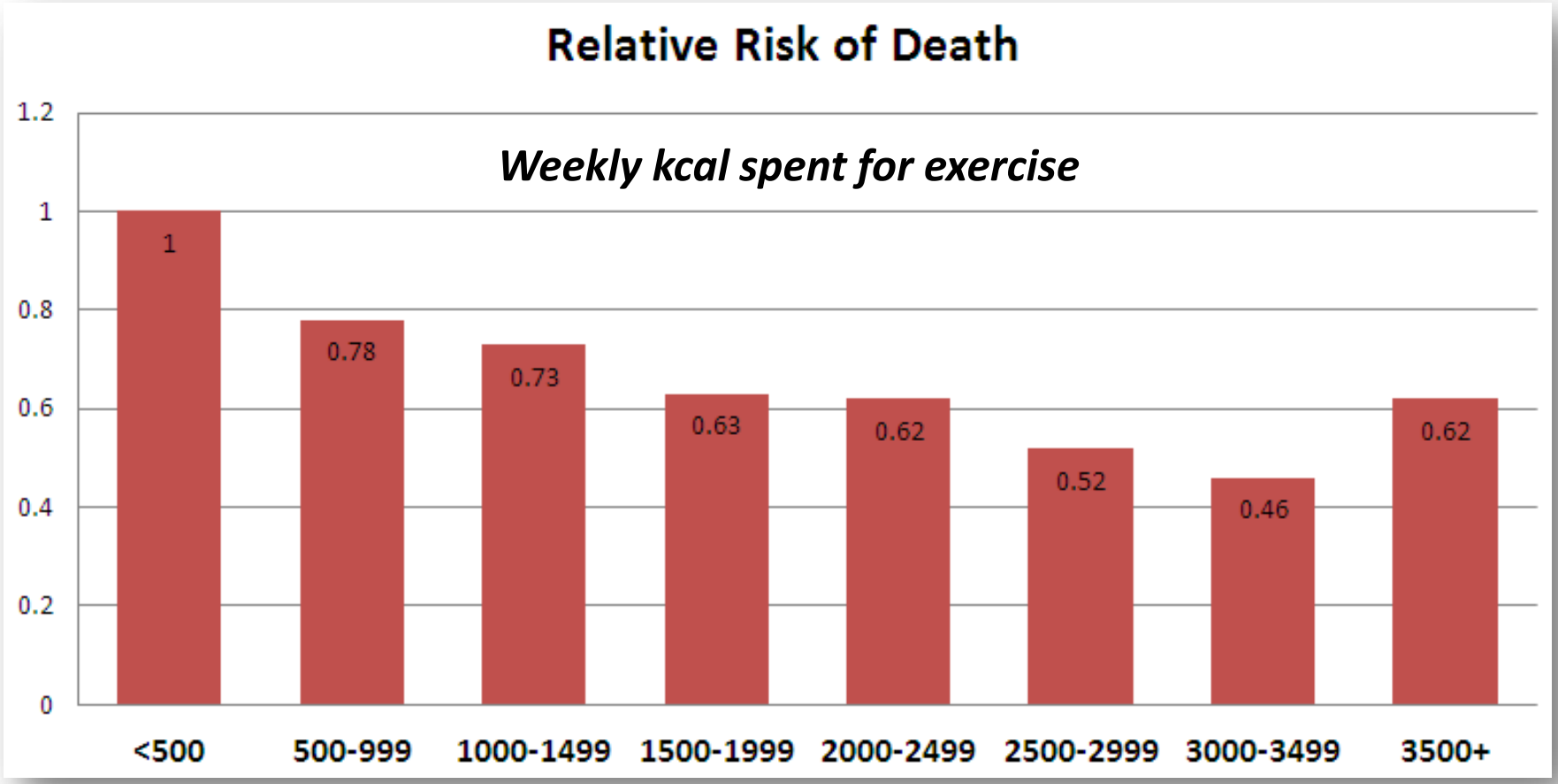
Figure 1
Activity pyramid. (Adapted from: “The Activity Pyramid” © ParkNicolletHealthSource®, Minneapolis, U.S.A. used with permission.)

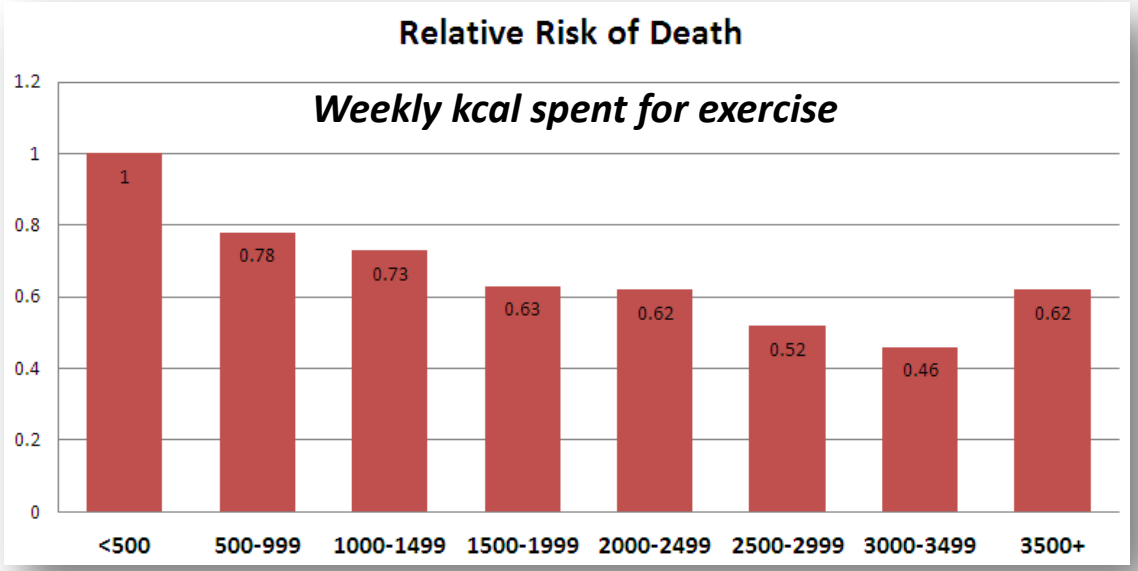


Vol. 314 No. 10 THE NEW ENGLAND JOURNAL OF MEDICINE 605

PHYSICAL ACTIVITY, ALL-CAUSE MORTALITY, AND LONGEVITY OF COLLEGE ALUMNI

RALPH S. PAFFENBARGER, JR., M.D., DR.P.H., ROBERT T. HYDE, M.A., ALVIN L. WING, M.B.A., AND CHUNG-CHENG HSIEH, SC.D.





Paffenbarger et at, NEJM 1986;314:605

½ Stunde langsames Joggen pro Tag:
7*210 Kcal=1470 Kcal/Woche

½ Stunde zügiges Joggen pro Tag:
7*420 Kcal=2940 Kcal/Woche

Tätigkeit	Metabolisches Äquivalent (MET)*	Kcal/h für eine 70kg schwere Person
Fernsehen	1,4	98
Leichte Hausarbeit	2,5	175
Spazierengehen mit dem Hund	3,0	210
Schwere Hausarbeit	4,0	280
Golf	4,8	336
Skifahren	5,3	371
Klassisches Tanzen	5,5	385
Langsames Joggen (6.5 km/h)	6,0	420
Tennis	7,3	511
Fussball	8,0	560
Velo (20–25 km/h)	8,0	560
Zügiges Joggen (12 km/h)	12,0	840
Mountainbike bergauf	14,0	980
Rennvelo (>30 km/h)	15,8	1106

Tabelle 1
Energieverbrauch bei verschiedenen körperlichen Aktivitäten. * Ein metabolisches Äquivalent (MET) entspricht dem Grundumsatz und einer Sauerstoffaufnahme von 3.5 ml/min/kg. Quelle: Compendium of Physical Activities, http://sites.google.com/site/compendiumofphysicalactivities (accessed 2012, January 11th).

Wilhelm, PrimaryCare 2012;12:94-96

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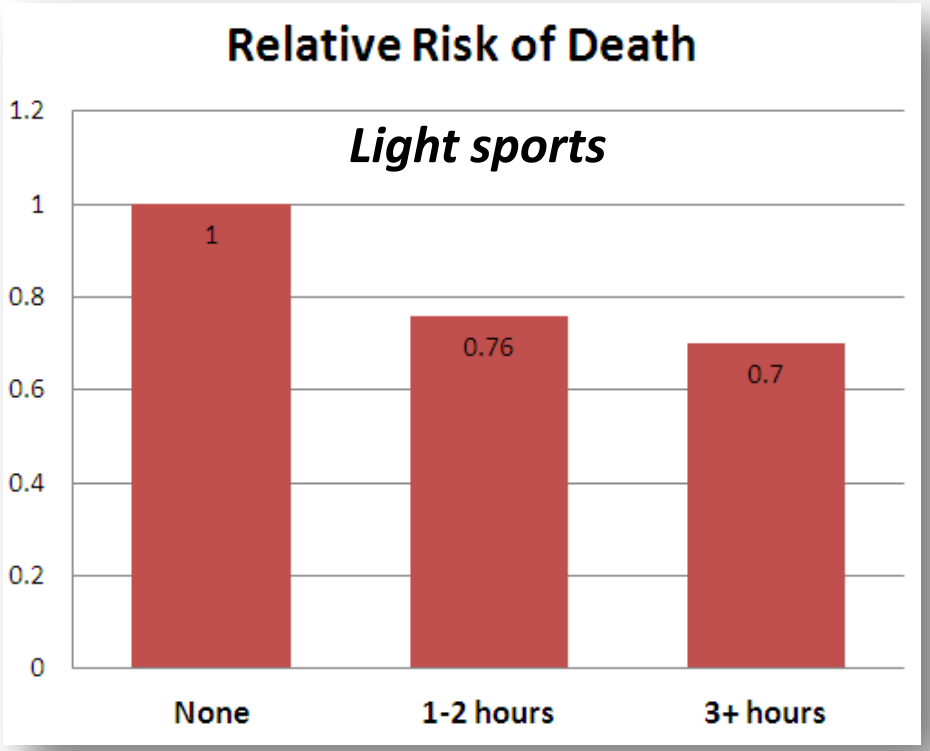
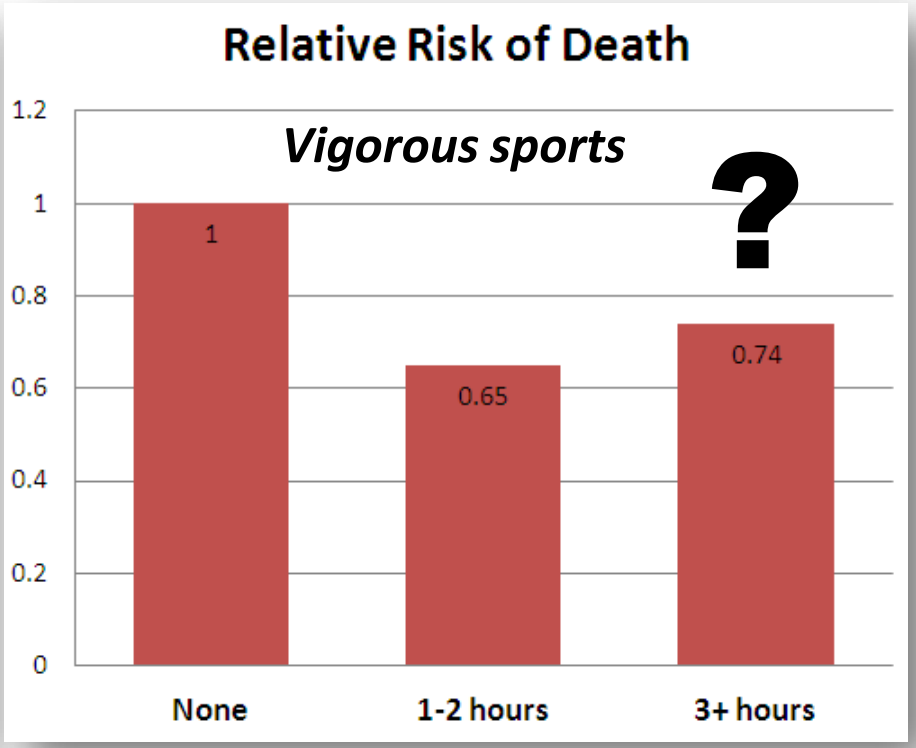
PHYSICAL ACTIVITY, ALL-CAUSE MORTALITY, AND LONGEVITY OF COLLEGE ALUMNI

RALPH S. PAFFENBARGER, JR., M.D., DR.P.H., ROBERT T. HYDE, M.A., ALVIN L. WING, M.B.A., AND CHUNG-CHENG HSIEH, SC.D.

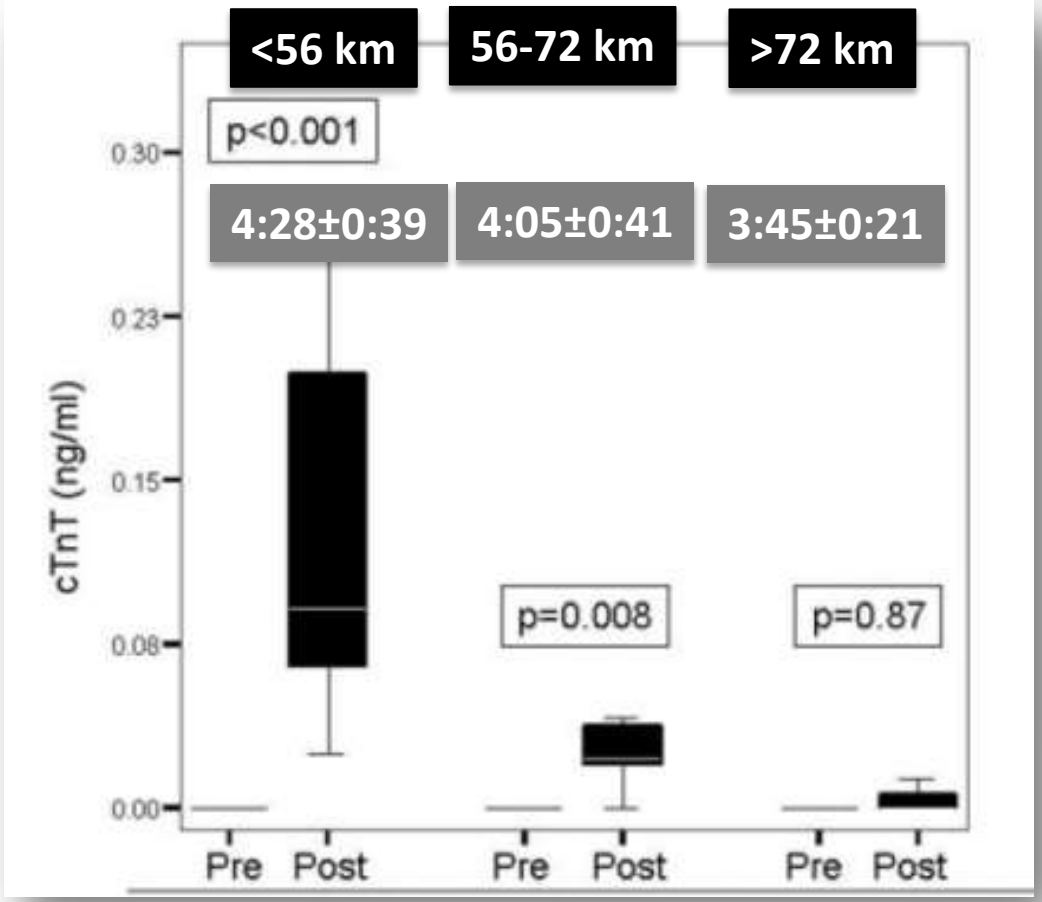




Exercise Physiology

Myocardial Injury and Ventricular Dysfunction Related to Training Levels Among Nonelite Participants in the Boston Marathon

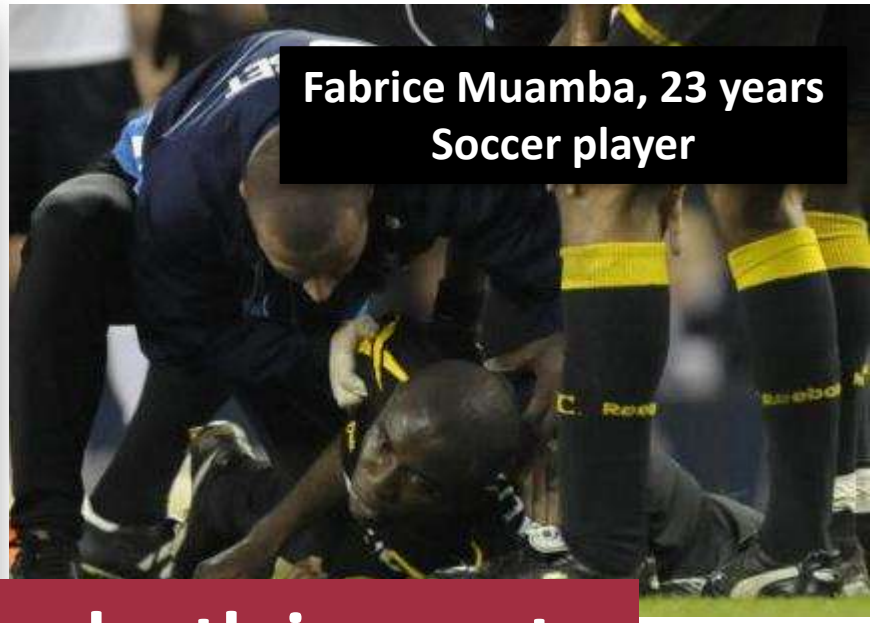
Tomas G. Neilan, MD; James L. Januzzi, MD; Elizabeth Lee-Lewandrowski, PhD; Thanh-Thao Ton-Nu, MD; Danita M. Yoerger, MD; Davinder S. Jassal, MD; Kent B. Lewandrowski, MD; Arthur J. Siegel, MD; Jane E. Marshall, RDCS; Pamela S. Douglas, MD; David Lawlor, MD; Michael H. Picard, MD; Malissa J. Wood, MD



Mean age 41±11 years

Circulation 2006;114;2325-2333

Piermario Morosini, 25 years
Soccer player



Fabrice Muamba, 23 years
Soccer player

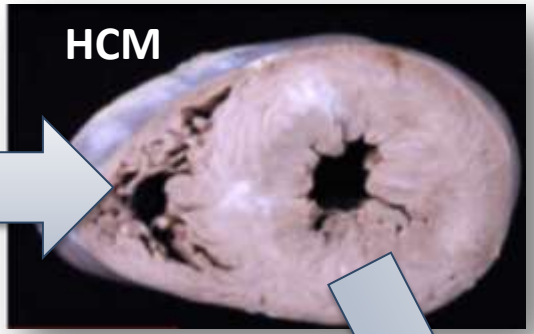
Sudden cardiac death in sports

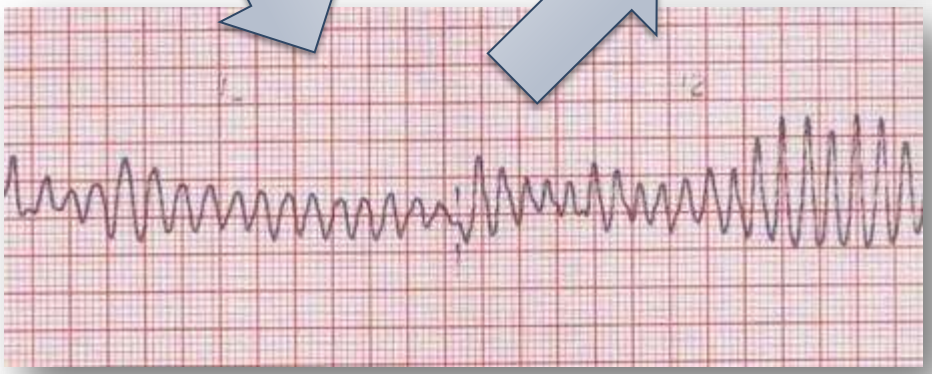
Alexander Dale Oen, 26 years
Swimmer

Claire Squires, 30 years
Marathon runner

Sport is a TRIGGER of ventricular arrhythmias in athletes with heart disease

Marc-Vivien Foé, Kamerun
† FIFA Confederations Cup 2003
Stade de Gerland, Lyon France





Vigorous activity, competition

Underlying heart disease

Sudden cardiac death

Epidemiology and Prevention

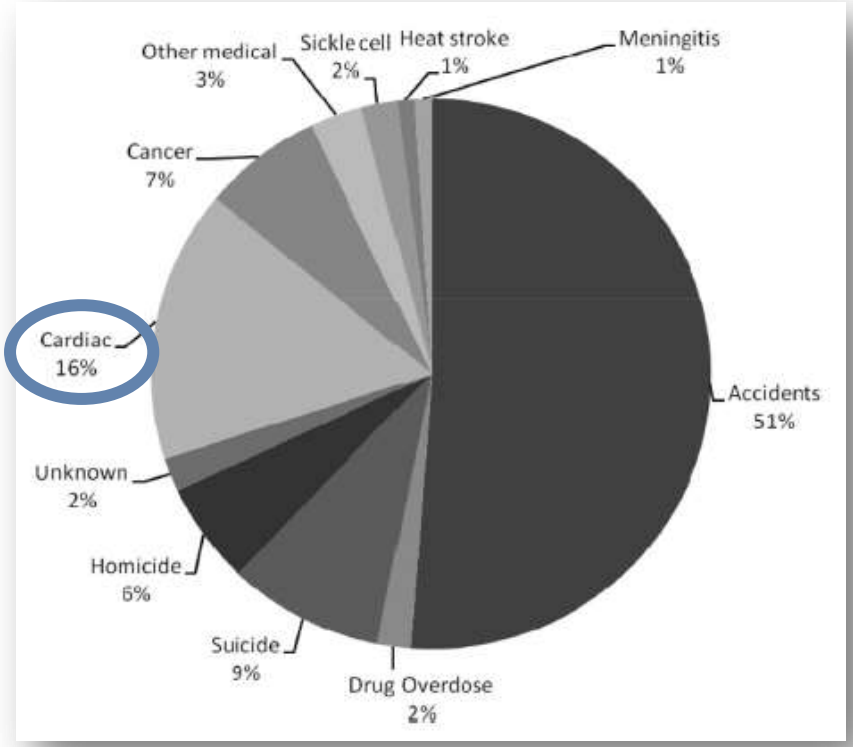
Incidence of Sudden Cardiac Death in National Collegiate Athletic Association Athletes

Kimberly G. Harmon, MD; Irfan M. Asif, MD; David Klossner, ATC, PhD; Jonathan A. Drezner, MD

Overall: 2.28/100,000/Year

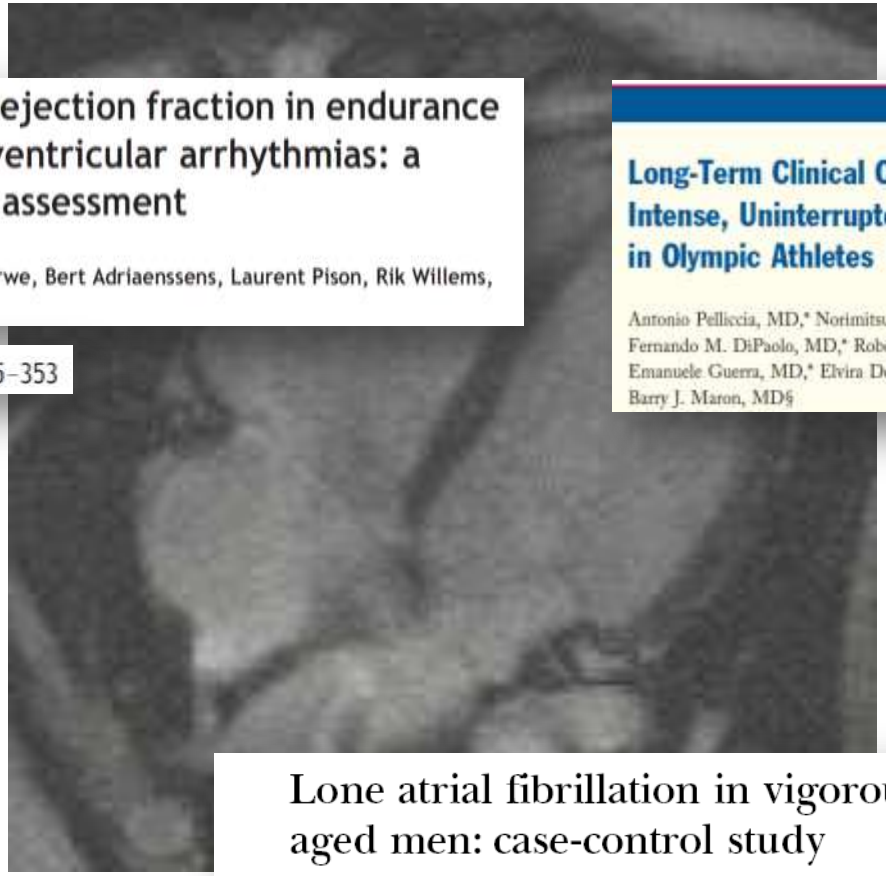
Female athletes: 1.30/100,000/Year

Male athletes: 3.02/100,000/Year



Circulation. 2011;123:1594-1600.

Is sport a PROMOTER of arrhythmias in healthy athletes?



Reduced right ventricular ejection fraction in endurance athletes presenting with ventricular arrhythmias: a quantitative angiographic assessment

Joris Ector, Javier Ganame, Nico van der Merwe, Bert Adriaenssens, Laurent Pison, Rik Willems, Marc Gewillig, and Hein Heidbüchel*

European Heart Journal (2007) **28**, 345–353

Exercise Conditioning

Long-Term Clinical Consequences of Intense, Uninterrupted Endurance Training in Olympic Athletes

Antonio Pelliccia, MD,* Norimitsu Kinoshita, MD,† Cataldo Pisicchio, MD,* Filippo Quattrini, MD,* Fernando M. DiPaolo, MD,* Roberto Ciardo, MD,* Barbara Di Giacinto, MD,* Emanuele Guerra, MD,* Elvira De Blasiis, MD,* Maurizio Casasco, MD,* Franco Culasso, PhD,‡ Barry J. Maron, MD§

J Am Coll Cardiol 2010;55:1619–25

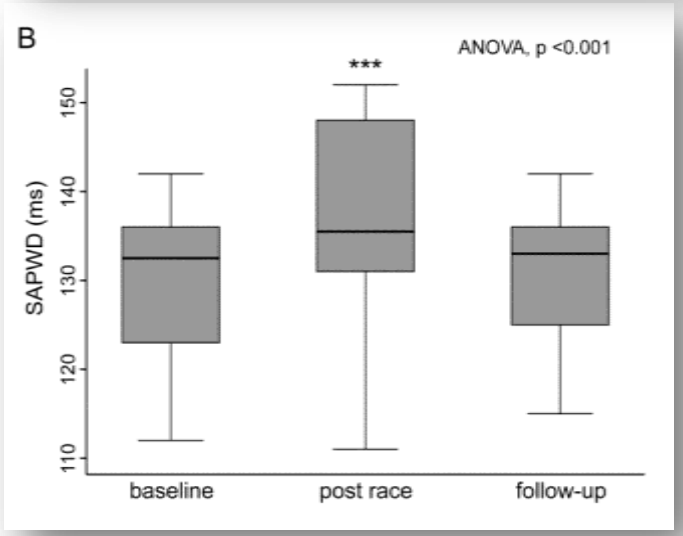
Lone atrial fibrillation in vigorously exercising middle aged men: case-control study

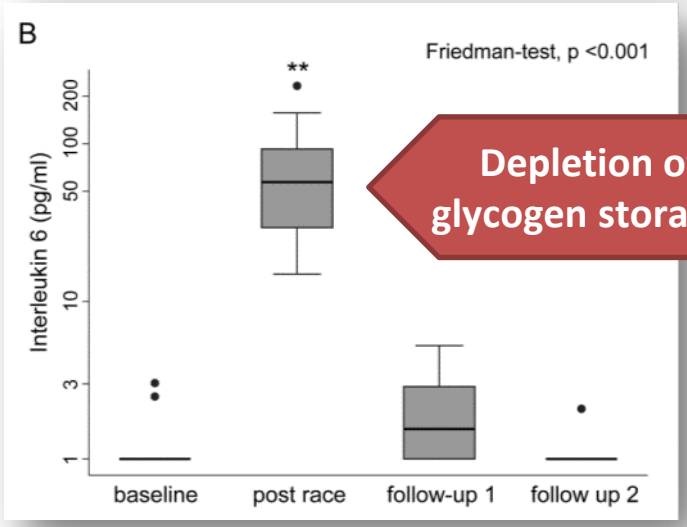
Jouko Karjalainen, Urho M Kujala, Jaakko Kaprio, Seppo Sarna, Matti Viitasalo

BMJ VOLUME 316 13 JUNE 1998

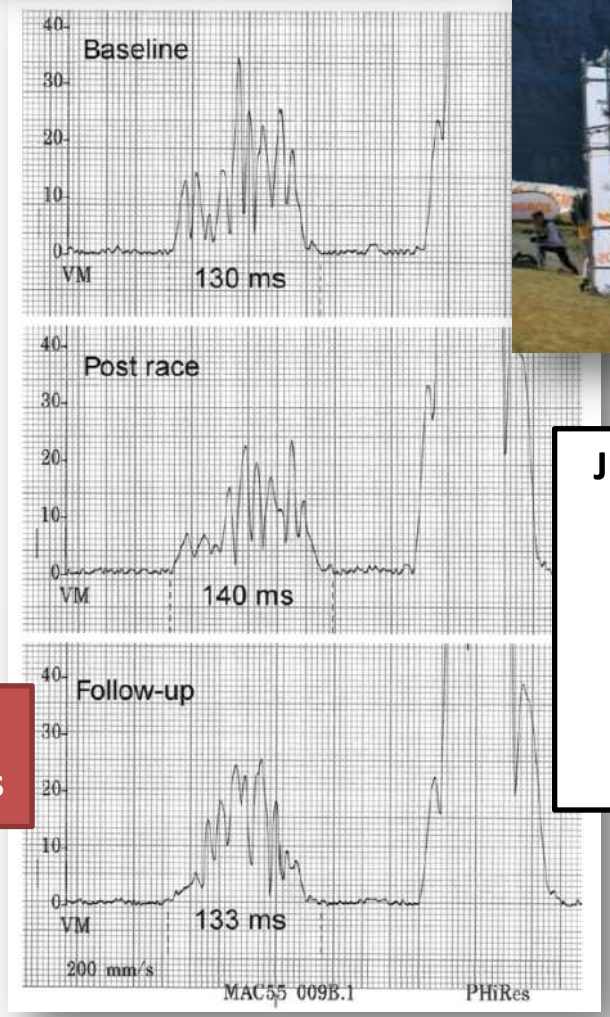
Inflammation and atrial remodeling after a mountain marathon

M. Wilhelm[1]*, T. Zueger[2]*, S. De Marchi[1], S. F. Rimoldi[1], N. Brugger[1], R. Steiner[3], C. Stettler[2], J.-M. Nuoffer[4], C. Seiler[1], M. Ith[5]





Depletion of glycogen storages



Jungfrau Marathon 2010
10 athletes
mean age 35±4 years
VO_2peak
66.8 ± 5.8 ml/min/kg
race time
243.9 ± 17.7 min

Scand J Med Sci Sports 2012; 10.1111/sms.12030

European Heart Journal
doi:10.1093/eurheartj/eht188

CLINICAL RESEARCH

Risk of arrhythmias in 52 755 long-distance cross-country skiers: a cohort study

Kasper Andersen[1]*, Bahman Farahmand[2,3], Anders Ahlbom[2], Claes Held[1], Sverker Ljunghall[1], Karl Michaëlsson[4], and Johan Sundström[1]

"Among male participants of a 90 km cross-country skiing event, a faster finishing time and a high number of completed races were associated with higher risk of arrhythmias. This was mainly driven by a ***higher incidence of atrial fibrillation*** *and bradyarrhythmias.* ***No association with ventricular fibrillation or cardiac arrest*** *was found."*

Longevity of men capable of prolonged vigorous physical exercise: a 32 year follow up of 2259 participants in the Dutch eleven cities ice skating tour

Jan L C M van Saase, Willy M P Noteboom, Jan P Vandenbroucke

Br Med J 1990;**301**:1409-11

TABLE II—*Mortality in participants in the Dutch eleven cities ice skating race and tour*

	Years of follow up				All participants	Ratio (95% confidence interval) of observed to expected deaths
	0-9	10-19	20-29	30-32		
Race participants:						
Finished within time limit (n=100)	0/ 1·43	4/ 3·65	8/ 8·09	2/ 2·33	14/ 15·58	0·90 (0·48 to 1·44)
Not finished within time limit (n=140)	3/ 2·97	1/ 7·96	12/ 17·78	4/ 4·94	20/ 33·65	0·59 (0·36 to 0·89)
Tour participants:						
Finished within time limit (n=953)	9/16·70	27/ 39·47	63/ 85·46	21/24·85	120/166·46	0·72 (0·60 to 0·86)
Not finished within time limit (n=936)	11/22·77	47/ 53·83	86/103·29	23/27·76	167/207·65	0·80 (0·68 to 0·93)
Total (n=2129)	23/43·69	79/104·80	169/214·53	50/59·99	321/423·01	0·76 (0·68 to 0·85)

Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes

The Look AHEAD Research Group*

Intervention:

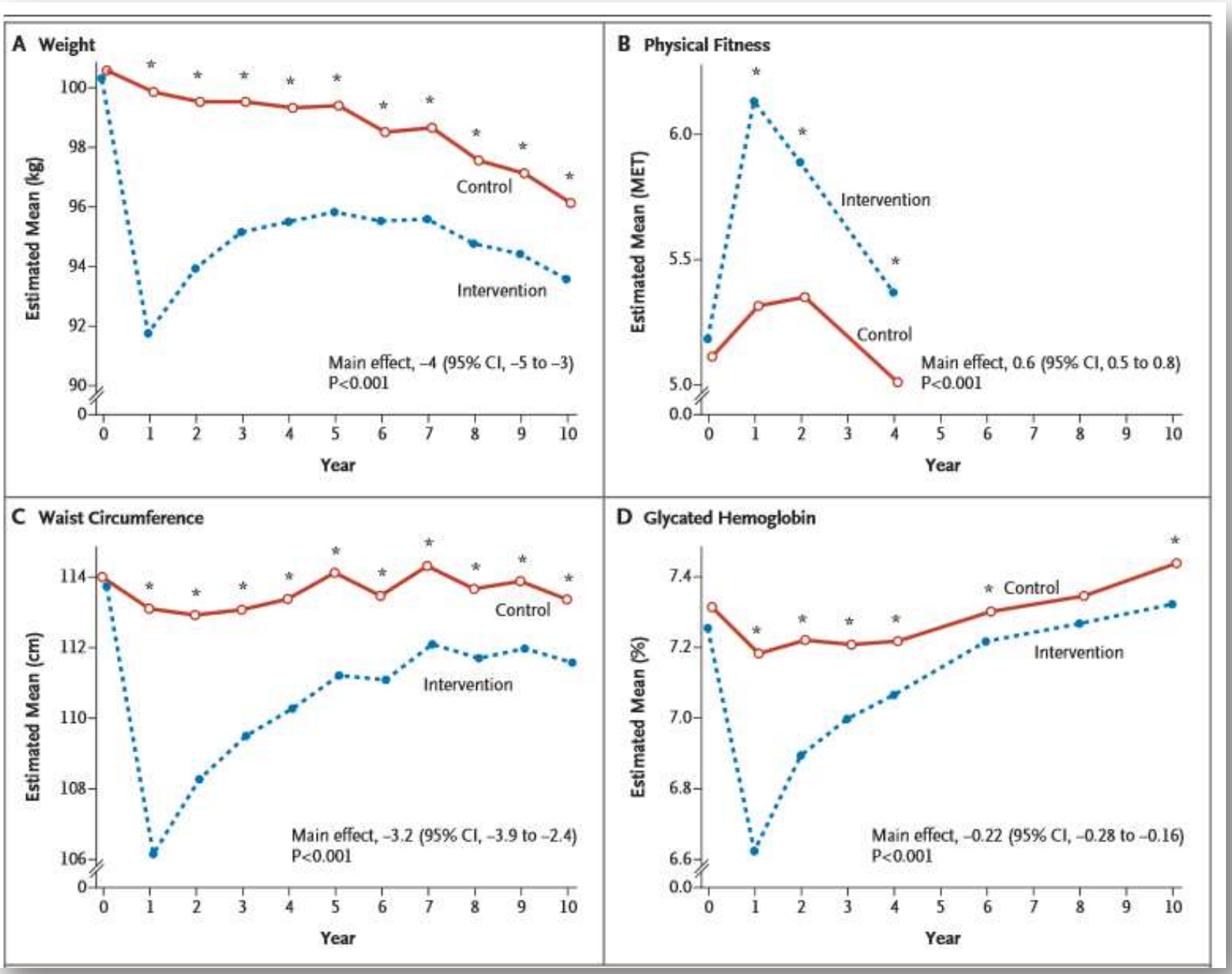
- Weight loss
  - goal -10% (mean -7%)
  - Meal replacement products
- Pyhsical activity increase
  - 175 min/week moderate intensity
  - 10,000 steps per day
- Lifestyle councelling sessions
  - Month 1-6: 4/week
  - Month 7-12: 3/month
  - Year 2+: individual 1/month
    2-3 yearly group classes

Medication adjustments by the patients' health care provider

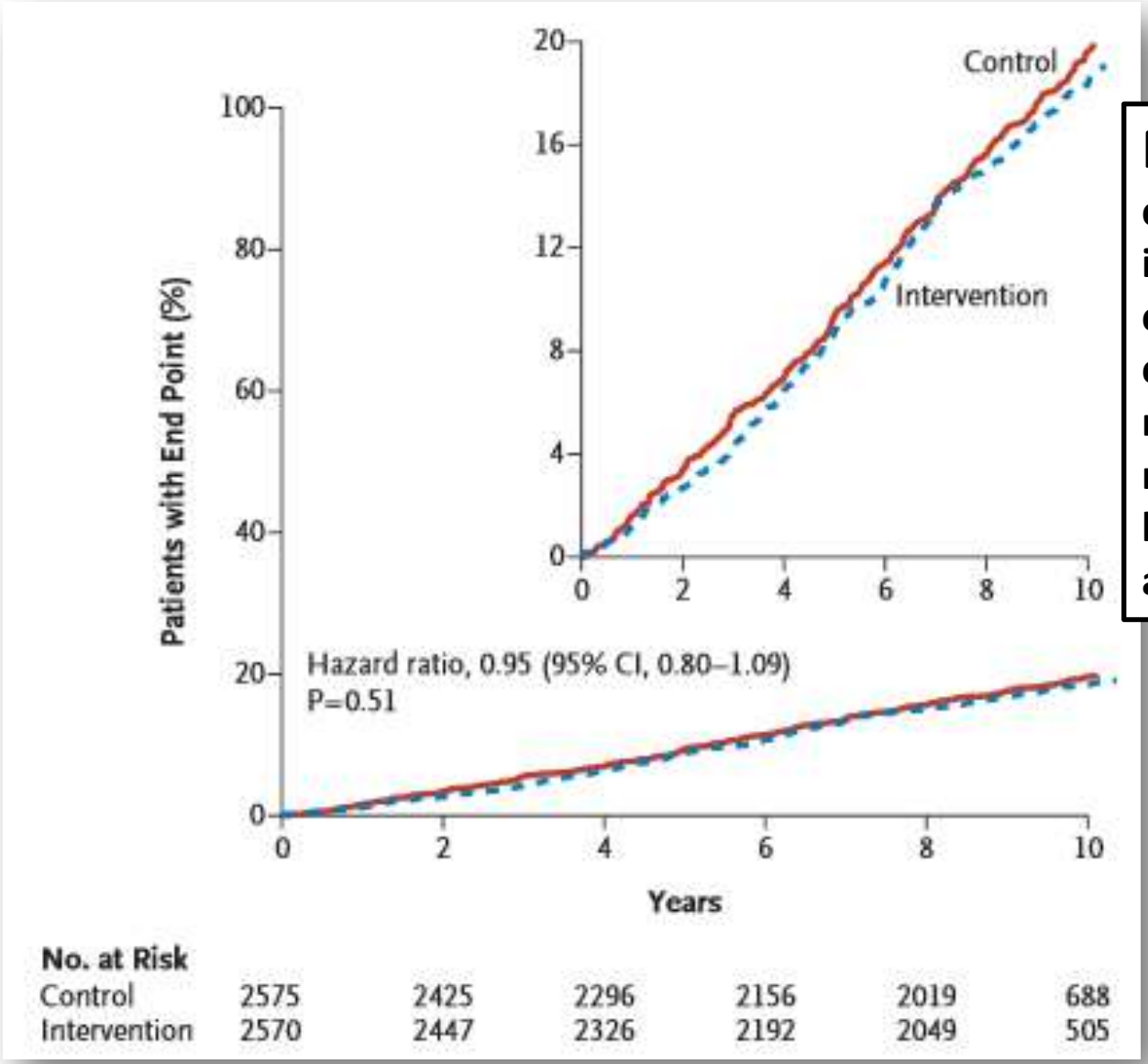
Table 1. Characteristics of the Patients at Baseline.*

Variable	Control Group (N=2575)	Intervention Group (N=2570)
Age — yr	58.9±6.9	58.6±6.8
Female sex — no. (%)	1537 (59.7)	1526 (59.4)
Race or ethnic group — no. (%)†		
Black	404 (15.7)	400 (15.6)
Native American	128 (5.0)	130 (5.1)
Asian or Pacific Islander	21 (0.8)	29 (1.1)
White	1631 (63.3)	1621 (63.1)
Hispanic	340 (13.2)	340 (13.2)
Other	51 (2.0)	50 (1.9)
History of cardiovascular disease — no. (%)‡	348 (13.5)	366 (14.2)
Use of insulin — no. (%)§	410 (16.5)	382 (15.4)
Current smoking — no. (%)	110 (4.3)	117 (4.6)
Median duration of diabetes (interquartile range) — yr	5.0 (2.0–10)	5.0 (2.0–10)
Weight — kg	101±19	101±20
Body-mass index¶	36.0±5.8	35.9±6.0
Waist circumference — cm	114±14	114±14
Glycated hemoglobin — %	7.3±1.2	7.2±1.1
Blood pressure — mm Hg		
Systolic	129±17	128±17
Diastolic	70.4±9.6	69.9±9.5
Cholesterol — mg/dl		
High-density lipoprotein	43.5±12	43.4±12
Low-density lipoprotein	112±32	112±32
Median triglycerides (interquartile range) — mg/dl	152 (107–218)	155 (110–221)

N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

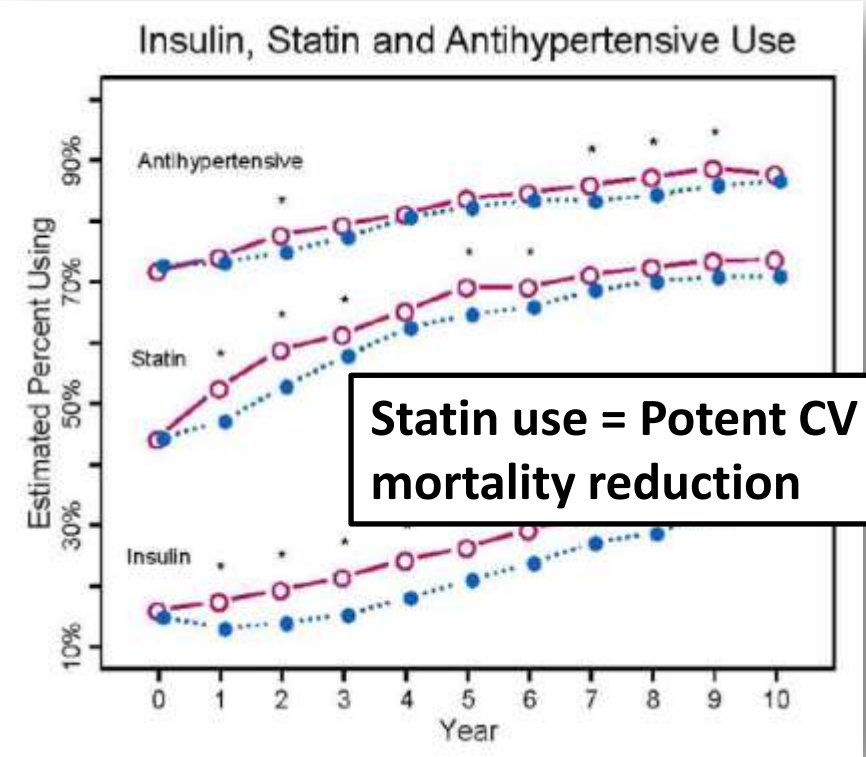


N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

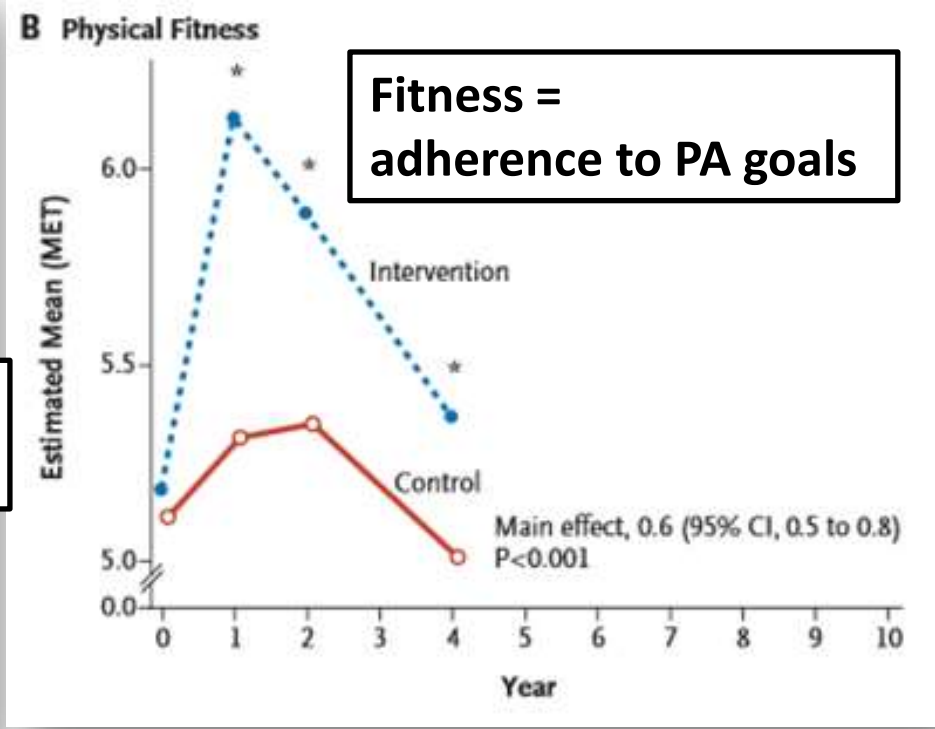


Primary end point:
composite outcome including death from cardiovascular causes, nonfatal myocardial infarction, nonfatal stroke, and hospitalization for angina.

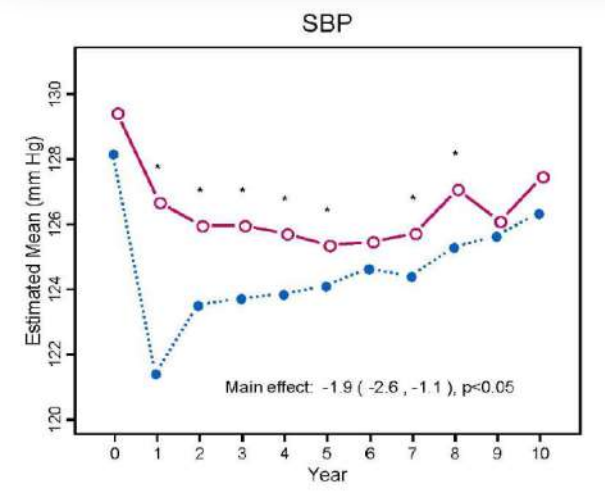
N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

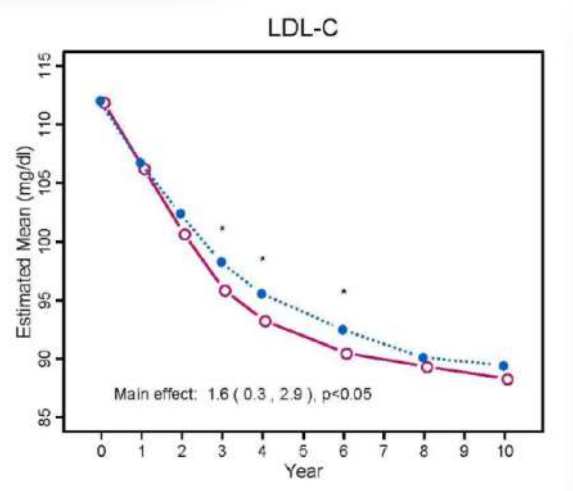


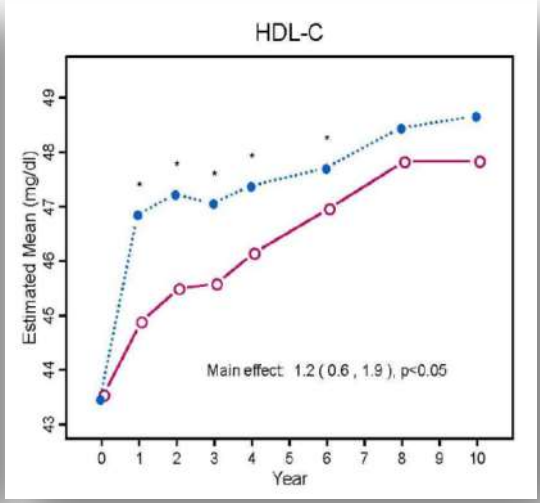
Statin use = Potent CV mortality reduction



Fitness = adherence to PA goals

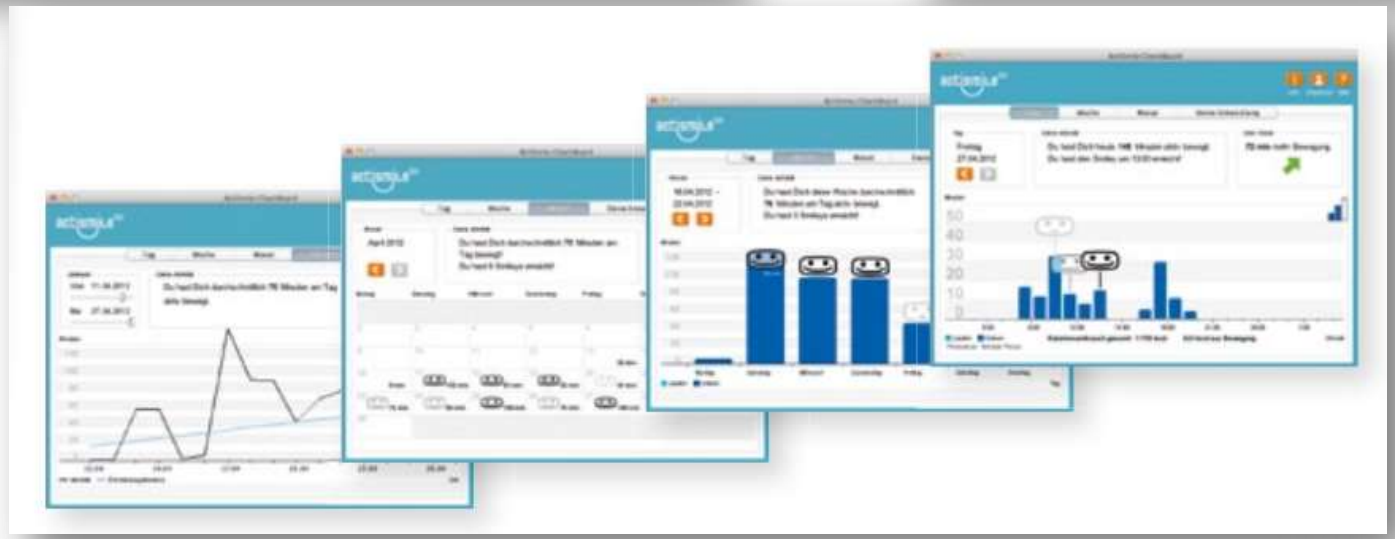






N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

Wichtigstes Ziel:
Motivation aufrechterhalten zur regelmässigen Aktivität mit ausreichender Intensität



Take home message: «Exercise as Medicine»

- Monotherapie in der Primärprävention von Herzkreislauf- und Krebserkrankungen mit sehr gutem Nutzen/Nebenwirkungs-Verhältnis, auch bei hoher Dosierung.
- Kombinationstherapie in der Sekundärprävention. Ergänzung, aber kein Ersatz für evidenzbasierte Medikamente.
- Muss regelmässig «eingenommen» werden.
- Muss manchmal bitter schmecken, sonst nützt sie nichts.