



Universidad de
los Andes

Facultad
de Medicina

15
años



FUNDACION
SANTA FE DE BOGOTA

Evidencia y Perspectivas en Actividad Física

John Duperly MD, PhD

Director – Instituto de Medicina del Ejercicio - FSFB

Profesor Asociado Universidad de los Andes

Conflictos de Interés

(Speaker, Advisory Board, Research Grants, Consultorias, Patrocinios)

Asocaña, Abbott, Alpina, Allianz, Astra-Zeneca, Bayer, Coca – Cola, MSD, FARMA, Gatorade, Merck, Nestlé, Nutraceuticals, Polar, Red Bull, Toma Café, Sanofi – Aventis, Novo-Nordisk, Van Camps

Minsalud, Coldeportes, Colciencias, Ascoafame
Fundación Santa Fe de Bogotá, Uniandes





“Ejercicio: un agente hipolipemiante, antihipertensivo, inotrópico positivo, cronotrópico negativo, vasodilatador, diurético, anorexígeno, reductor de peso, catártico, hipoglicemiante, tranquilizante, hipnótico y con cualidades antidepresivas ”

...además protector contra algunos tipos de cáncer y enfermedades neurodegenerativas, injuria neurológica y quirúrgica...

Roberts WC. Am J Cardiol. 1984 Jan 1;53(1):261-2.

Fitness: Capacidad o condición física, incluye capacidad cardiorrespiratoria, fuerza, flexibilidad, coordinación, equilibrio, velocidad y composición corporal.

Actividad Física:

Elevación de la tasa metabólica por actividad de los grandes grupos musculares.

Ejercicio:

Entrenamiento estructurado que busca mejorar algún aspecto del *fitness*.

Deporte:

Ejercicio con normas, reglas, competencia, premios, medallas.

Contribution of risk factors to achieving the 25 × 25 non-communicable disease mortality reduction target: a modelling study

Enf. Cardiovascular, Enf .Pulmonar, Cáncer, Diabetes

37 millones de muertes prematuras en 15 años

Factores de Riesgo:

Sedentarismo

Tabaco

Malnutricion

Alcohol

THE LANCET May 3; 2014

The New England Journal of Medicine

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VOLUME 346

MARCH 14, 2002

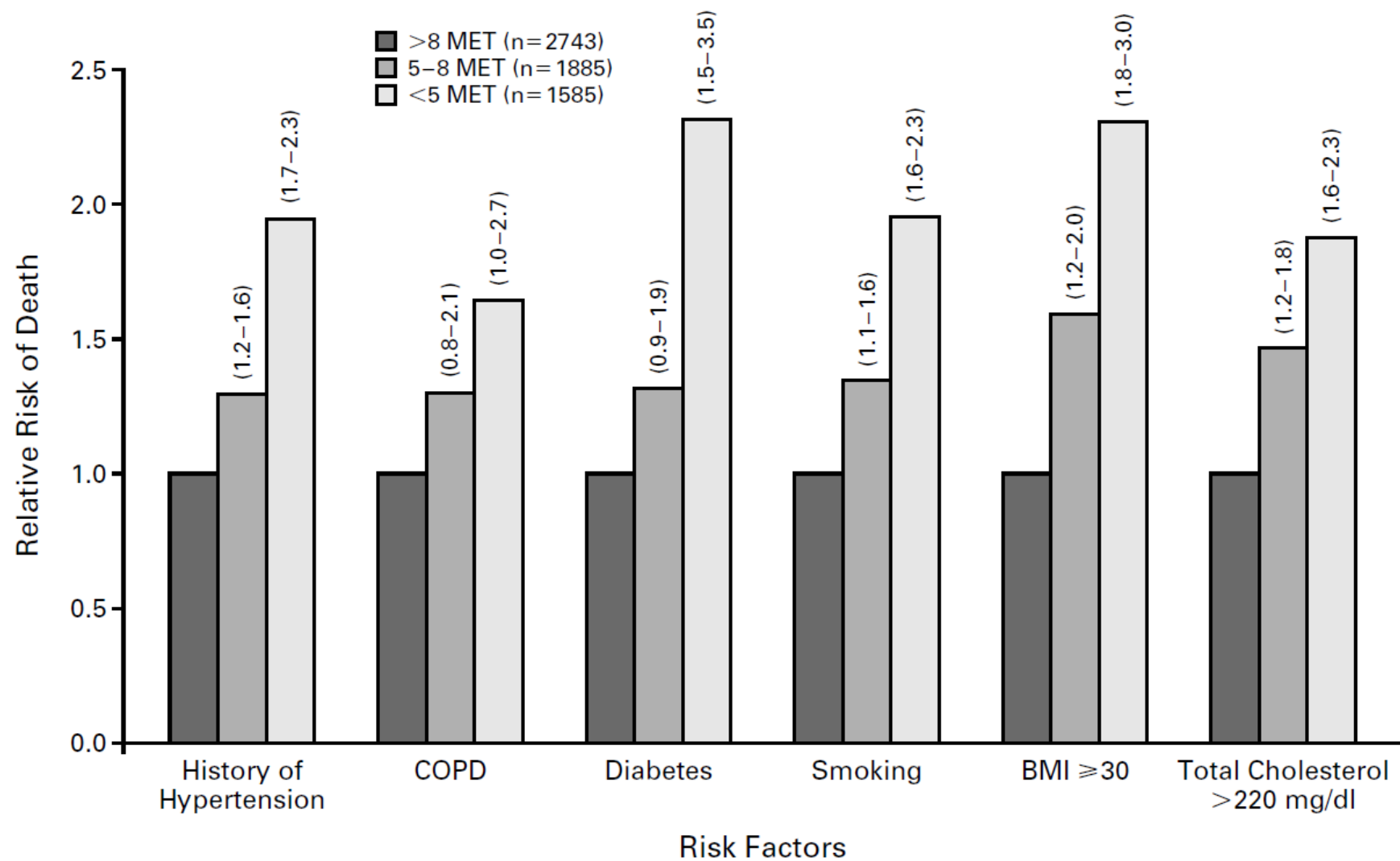
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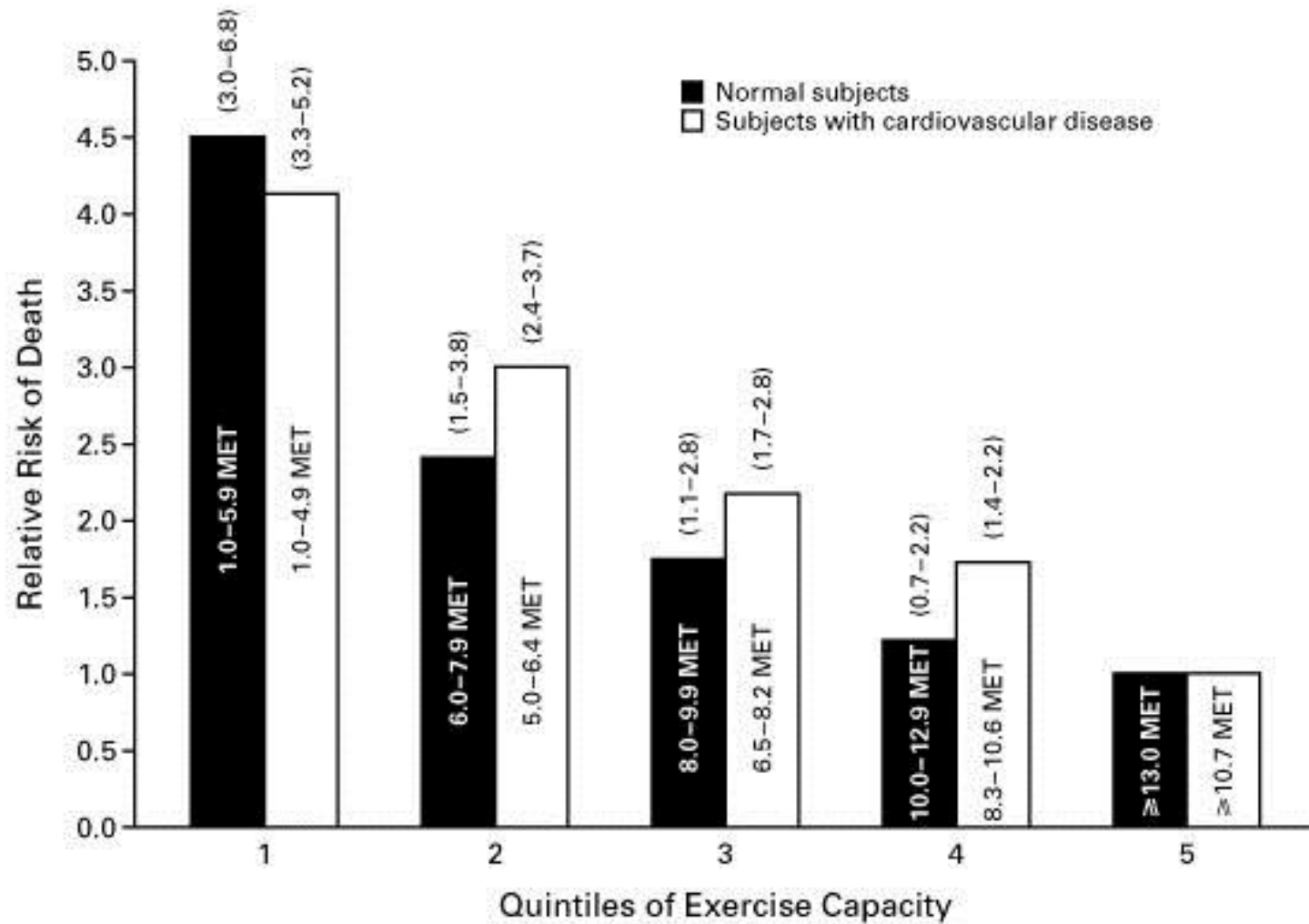
EXERCISE CAPACITY AND MORTALITY AMONG MEN REFERRED FOR EXERCISE TESTING

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.

EXERCISE CAPACITY AND MORTALITY



Mortalidad y Capacidad de Ejercicio



N Engl J. Med, Vol. 346, No. 11 - March 14, 2002

Survival of the Fittest — More Evidence

Gary J. Balady, M.D.

En 1859, Charles Darwin publicó su teoría de la evolución como una incesante lucha entre individuos, con diferentes grados de fitness, dentro de una especie. En ese tiempo, sus explicaciones crearon gran controversia pero revolucionaron el curso de la ciencia.

Los escritos de Darwin reflejaban conclusiones de años de estudio y observación. Ahora, 150 años después, en la era de la medicina basada en la evidencia y la rigurosidad del método científico, cuando el fitness es medido objetivamente y los sujetos son seguidos por años, los datos que soportan el concepto de la supervivencia del más “fit” son contundentes.

N Engl J Med 2002; 346:852-854

Panel 1: Health benefits of physical activity in adults³⁻⁵

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

THE LANCET

July, 2016

www.thelancet.com

Physical Activity 2016: Progress and Challenges

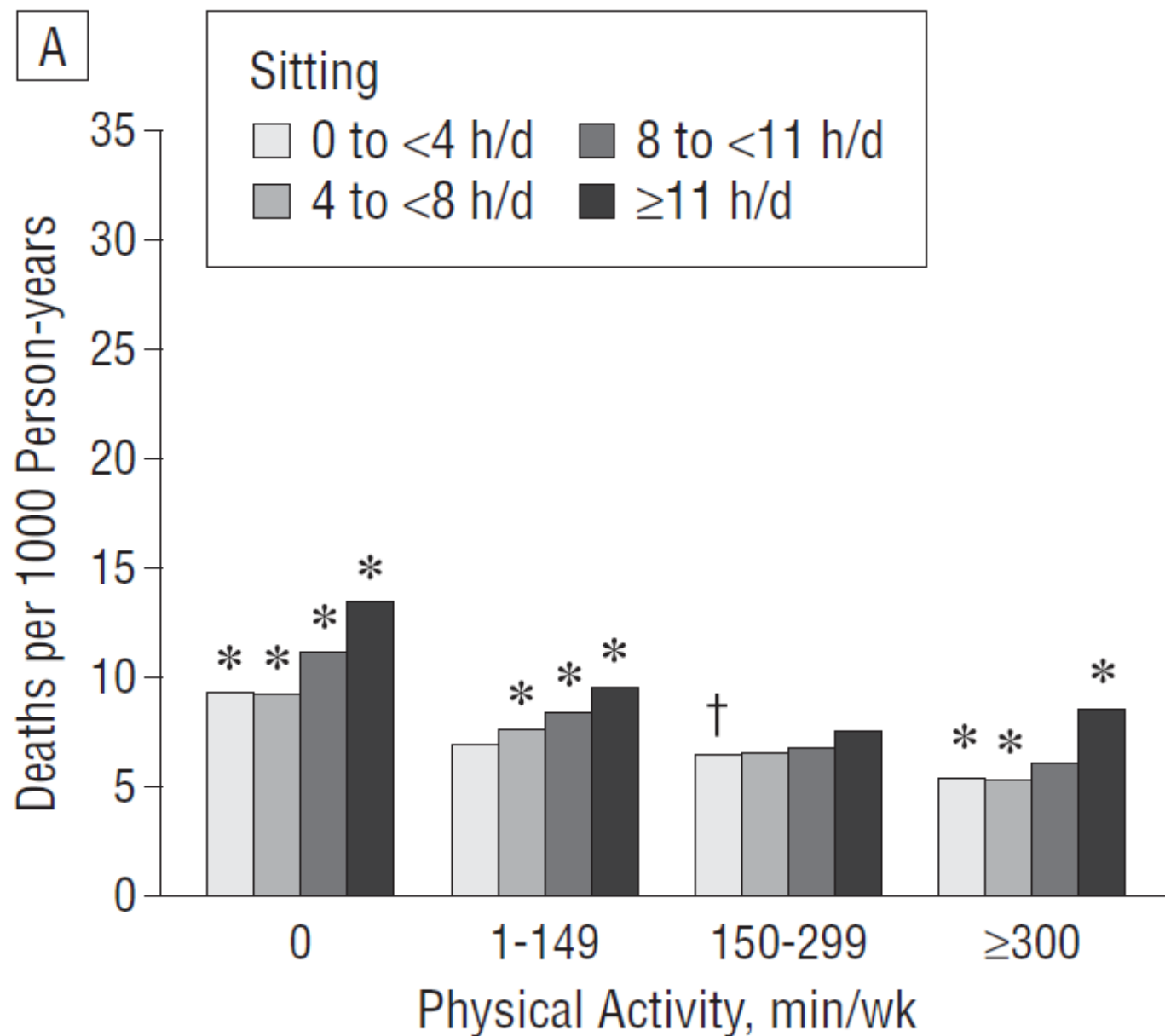
"We urge all sectors of government and society to take immediate, bold actions to help make active living a more desired, affordable, and accessible choice for all population groups."

Sitting Time and All-Cause Mortality Risk in 222 497 Australian Adults

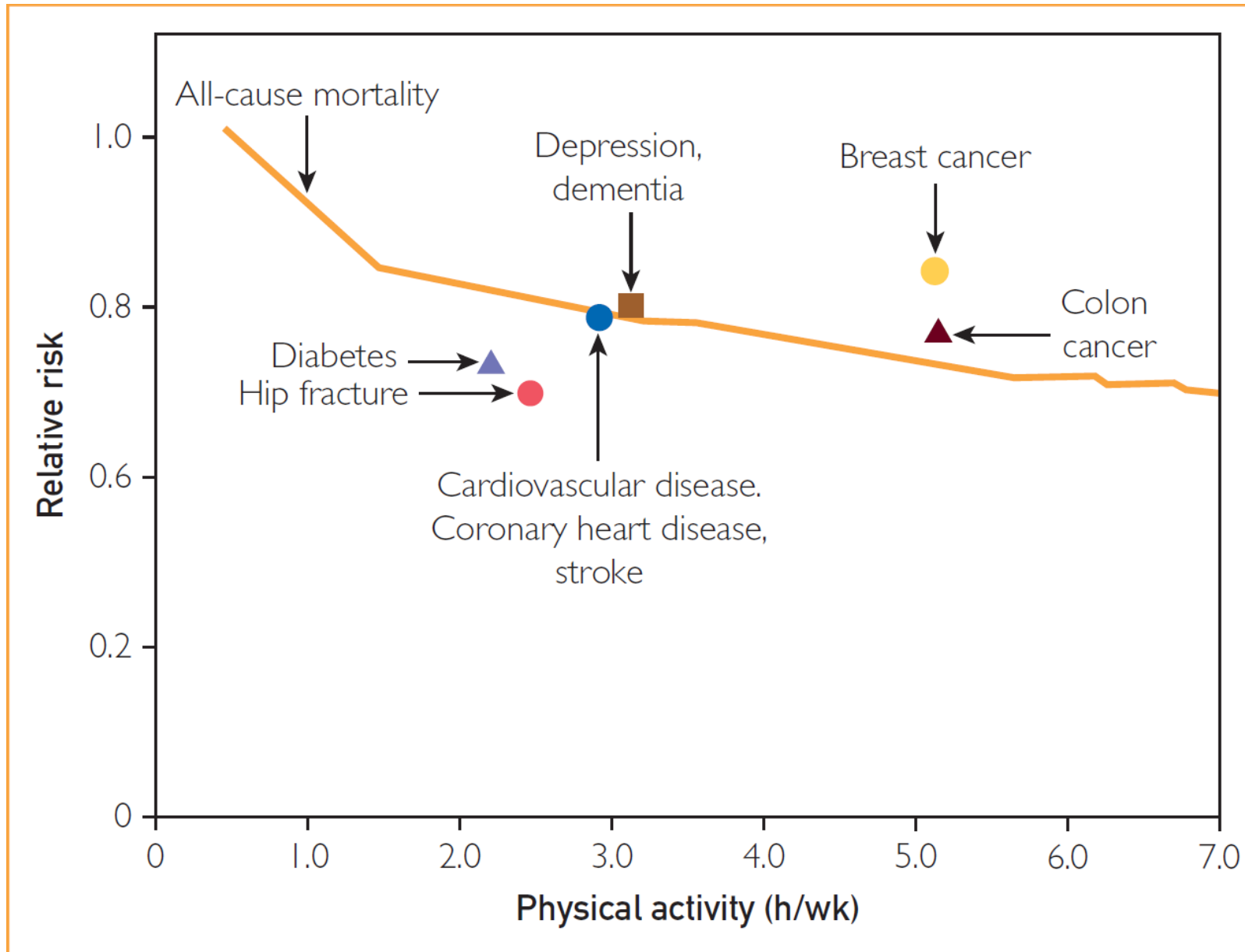
Hidde P. van der Ploeg, PhD; Tien Chey, MAppStats; Rosemary J. Korda, PhD; Emily Banks, MBBS, PhD; Adrian Bauman, MBBS, PhD

Conclusions: Prolonged sitting is a risk factor for all-cause mortality, independent of physical activity. Public health programs should focus on reducing sitting time in addition to increasing physical activity levels.

Arch Intern Med. 2012;172(6):494-500



Physical Activity Promotion in the Health Care System



SCIENTIFIC AMERICAN

January 2019





Rehabilitación
Cardiaca
Cardiac
Rehabilitation

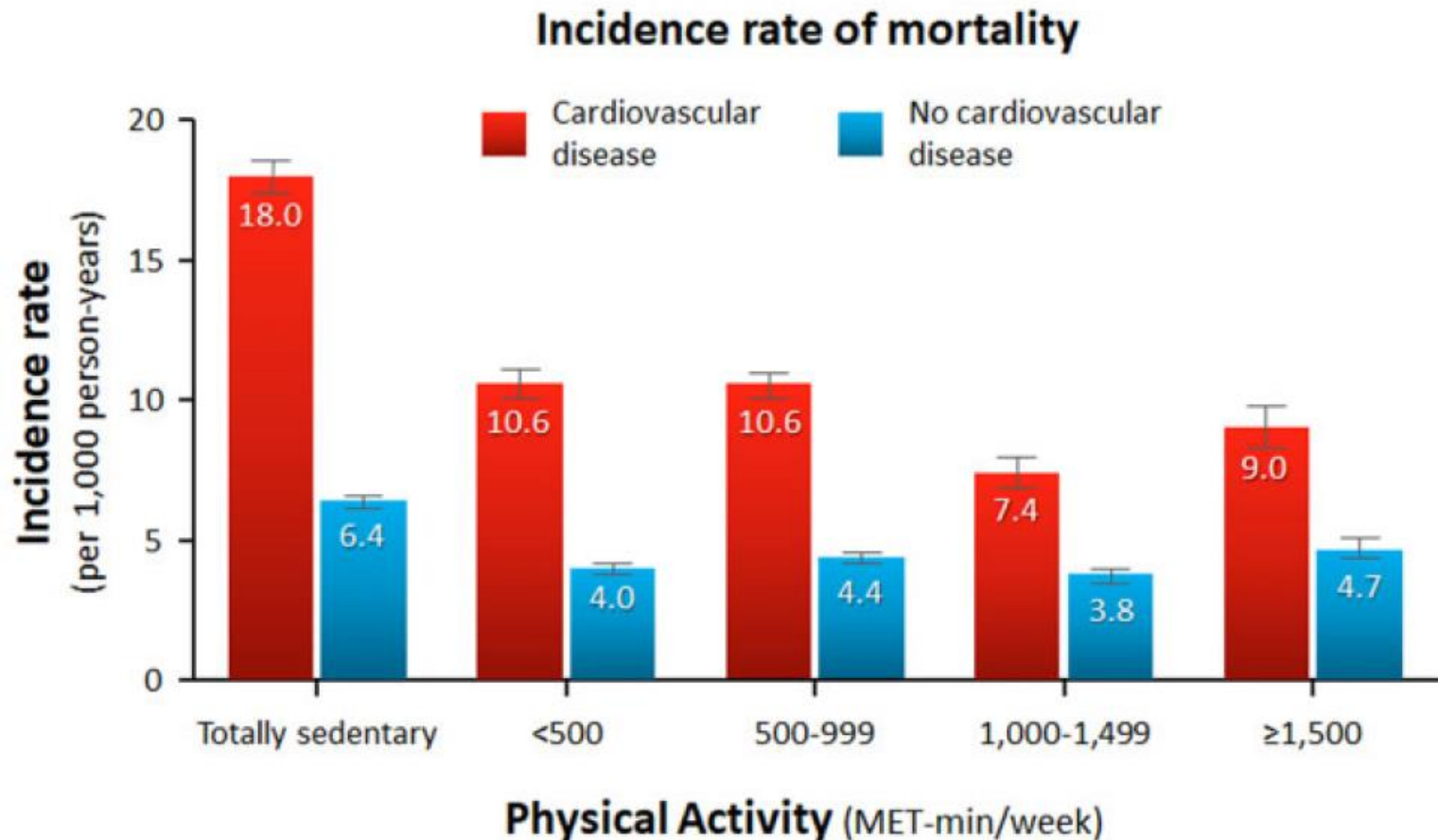


Yo creo que construir un mejor futuro en salud es posible



Fundación
Santa Fe de Bogotá

Mortality reduction with physical activity in patients with and without cardiovascular disease



Mortalidad y Actividad Física

This study included a total of 131 558 and 310 240 subjects with and without cardiovascular disease (CVD).

The study subjects were followed-up for a median of 5.9 years,

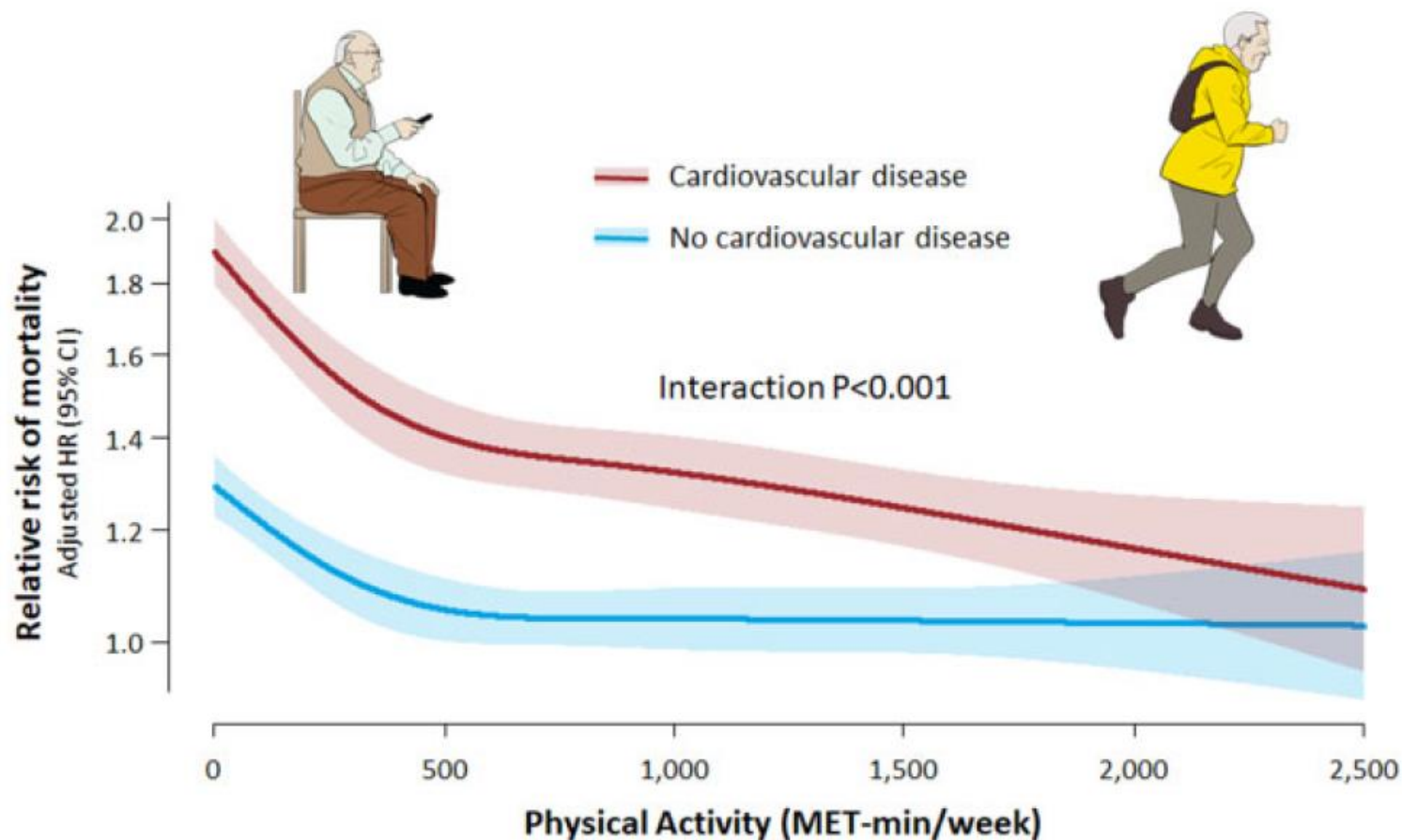
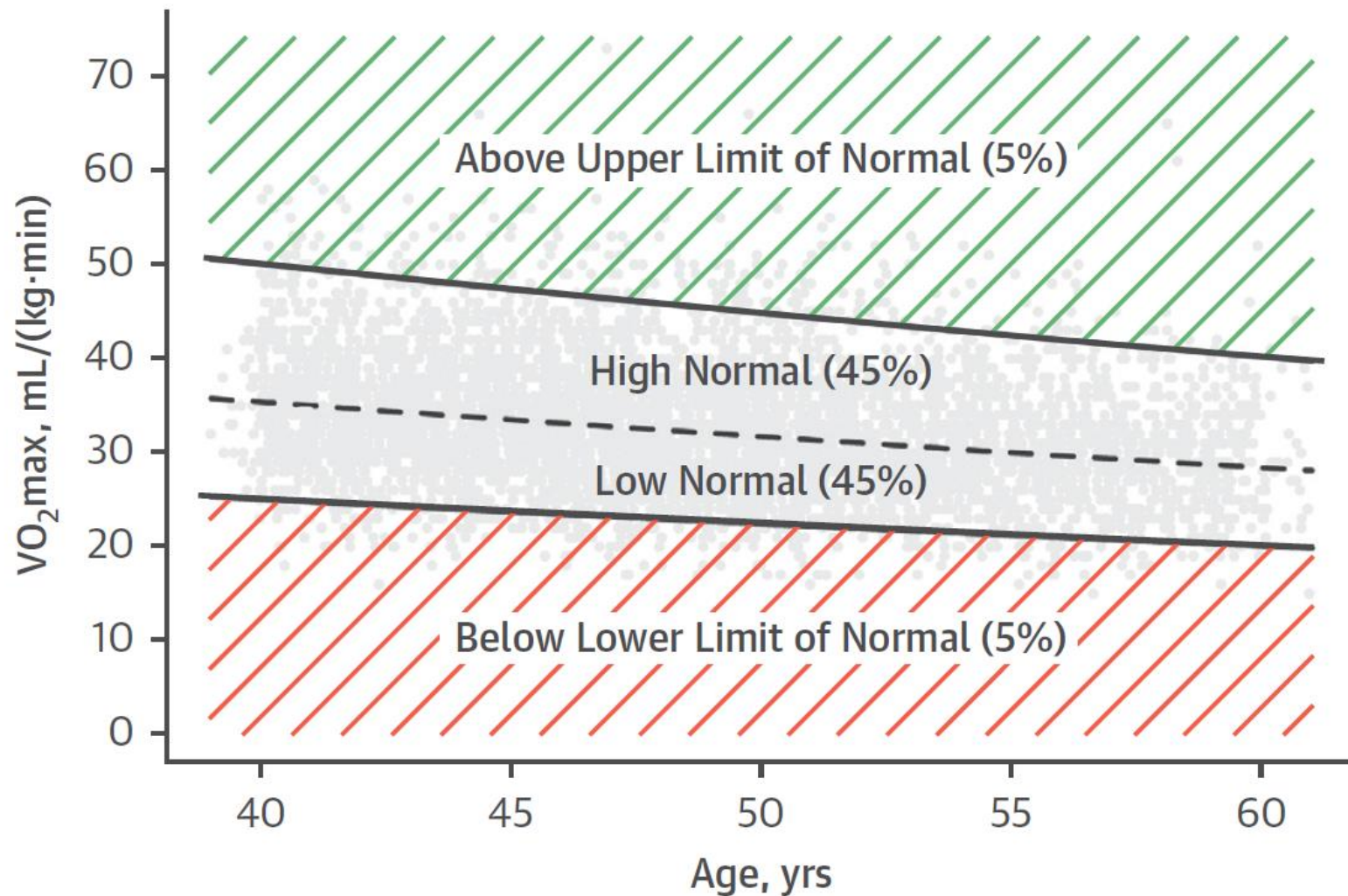


FIGURE 2 Distribution of CRF (Vo_2max) According to Age in 5,107 Middle-Aged, Employed Men Without CVD

JACC VOL. 72, NO. 9, 2018

AUGUST 28, 2018:987-95



CONCLUSIONS CRF was significantly related to longevity over the course of 4 decades in middle-aged, employed men free of CVD. The benefits of higher midlife CRF extend well into the later part of life. (J Am Coll Cardiol 2018;72:987-95)

Midlife Cardiorespiratory Fitness ($VO_2\text{max}$) & Cardiovascular Mortality

5107 Men free of CVD at Inclusion Followed up to 45 Years

Midlife Cardiorespiratory Fitness and the Long-Term Risk of Mortality

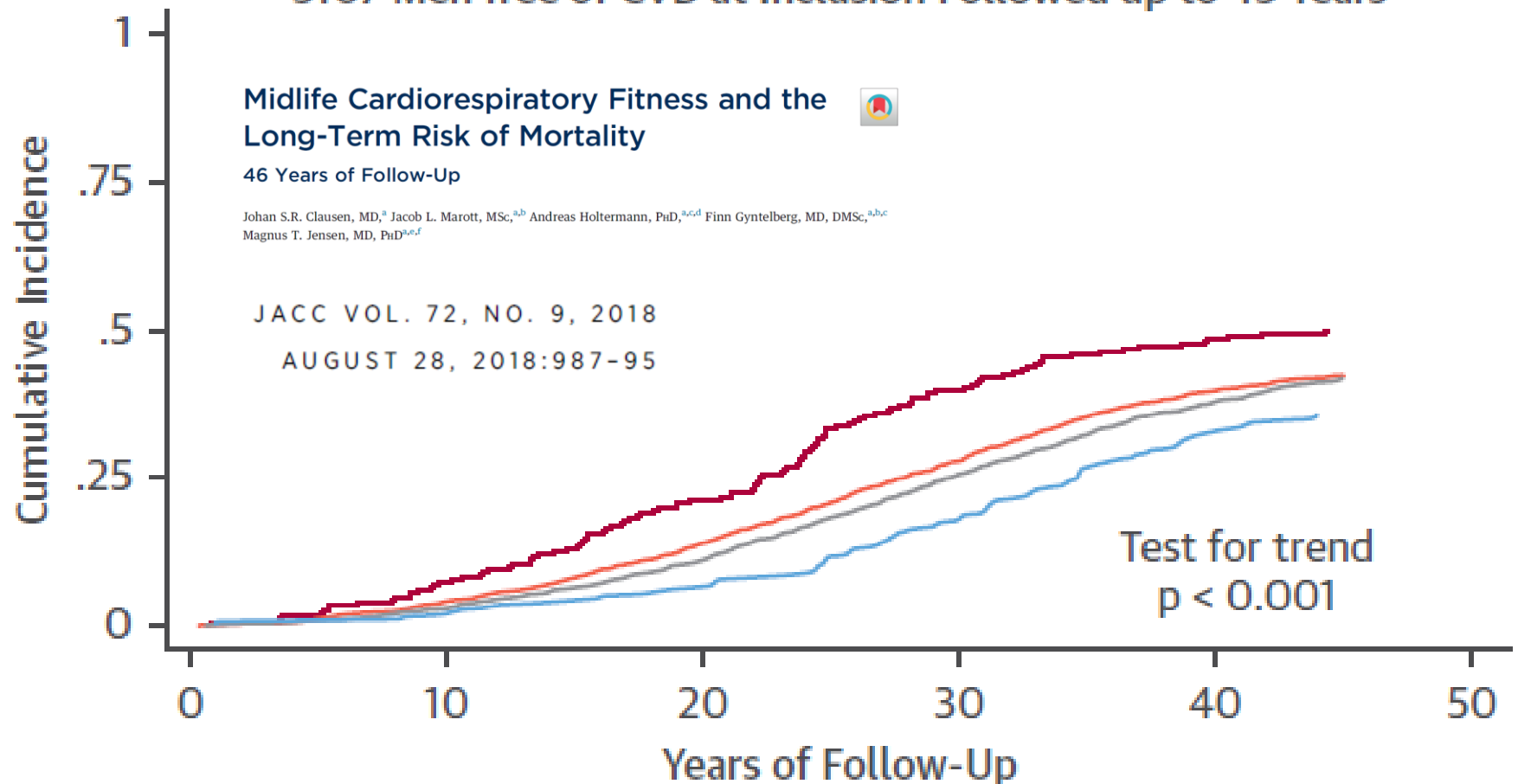


46 Years of Follow-Up

Johan S.R. Clausen, MD,^a Jacob L. Marott, MSc,^{a,b} Andreas Holtermann, PhD,^{a,c,d} Finn Gyntelberg, MD, DMSc,^{a,b,c}
Magnus T. Jensen, MD, PhD^{a,e,f}

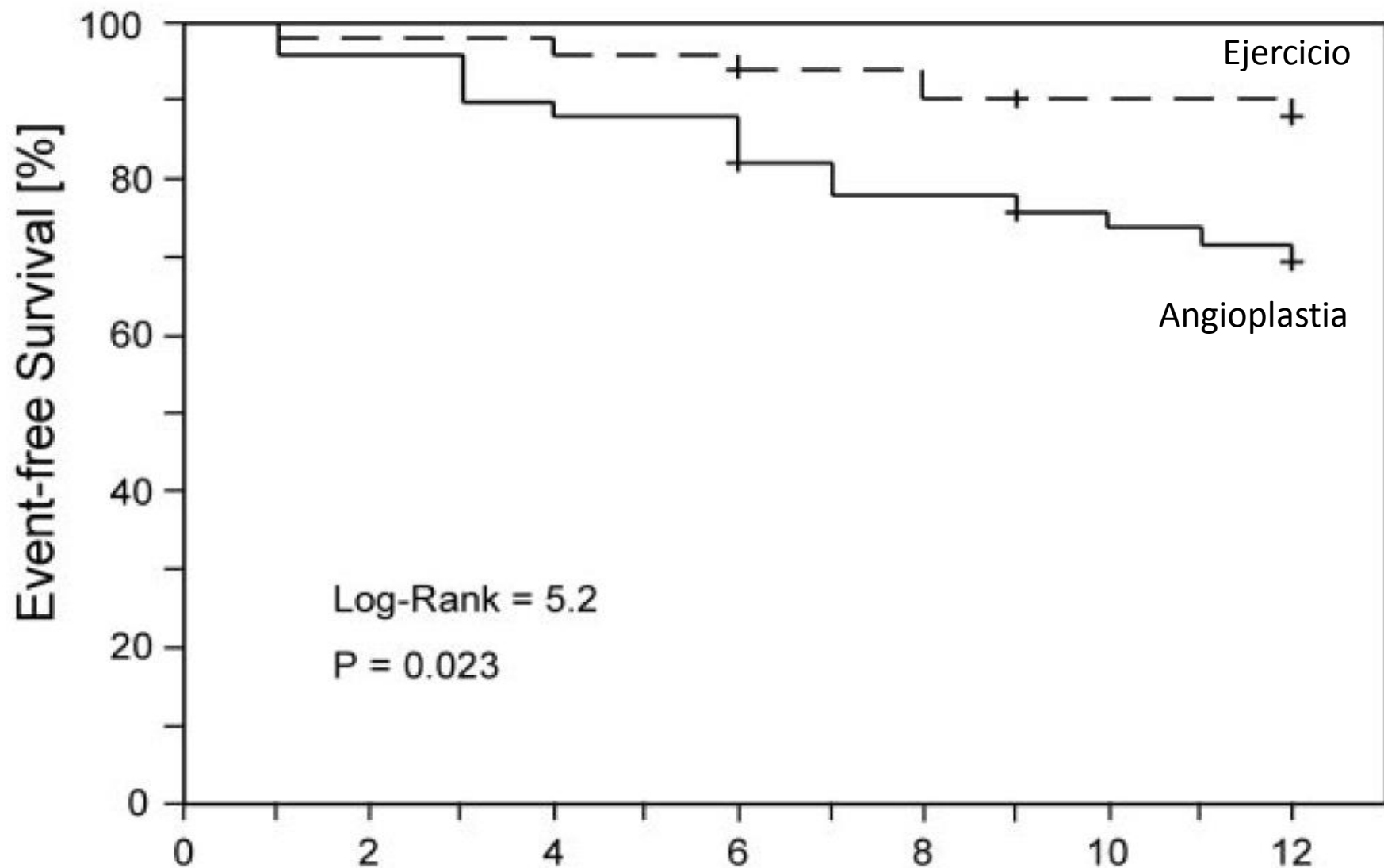
JACC VOL. 72, NO. 9, 2018

AUGUST 28, 2018:987-95



- Below Lower Limit of Normal ($VO_2\text{max}$)
- Low Normal ($VO_2\text{max}$)
- High Normal ($VO_2\text{max}$)
- Above Upper Limit of Normal ($VO_2\text{max}$)

Percutaneous Coronary Angioplasty Compared With Exercise Training in Patients With Stable Coronary Artery Disease: A Randomized Trial



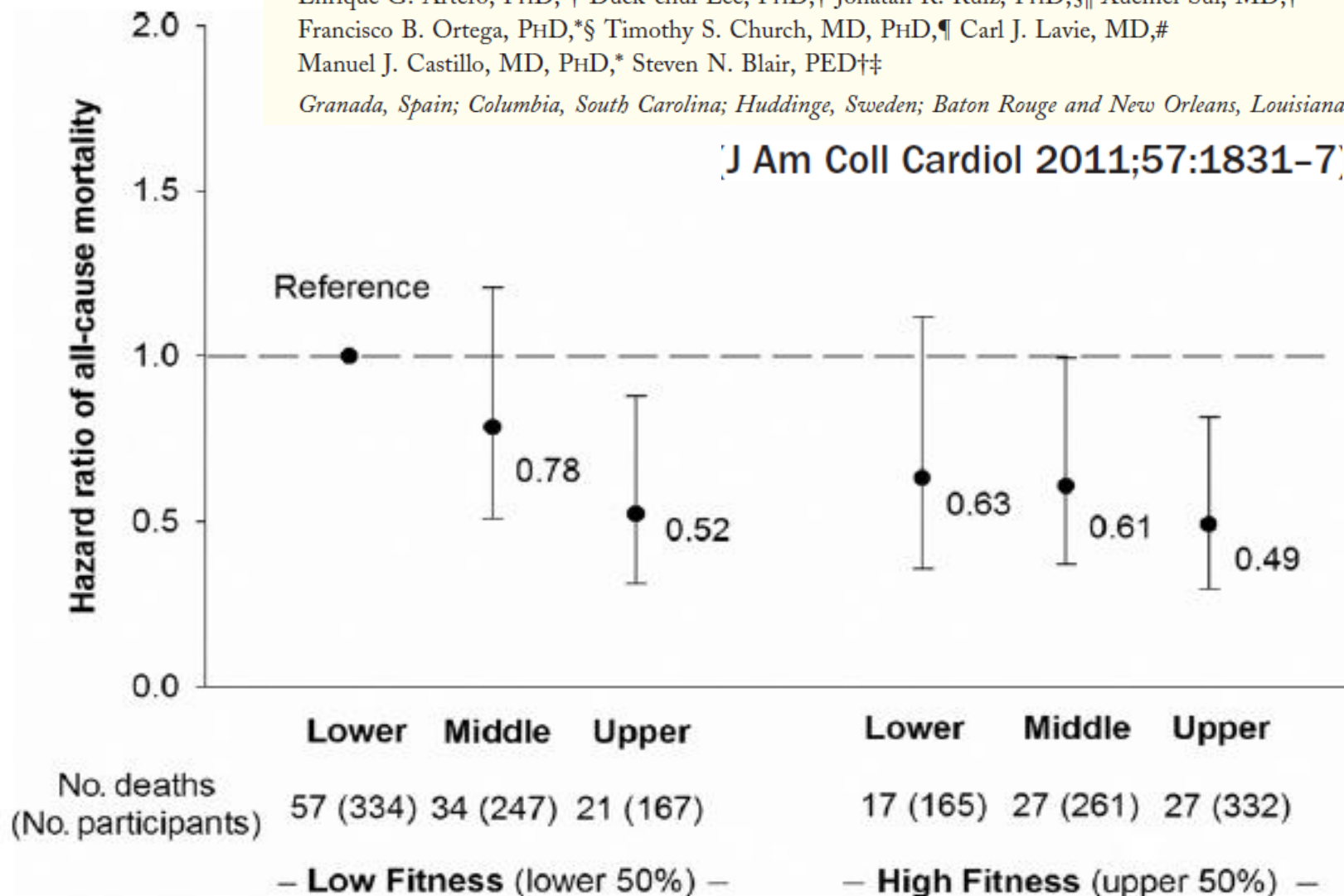
(*Circulation*. 2004;109:1371-1378.)

A Prospective Study of Muscular Strength and All-Cause Mortality in Men With Hypertension

Enrique G. Artero, PhD,*† Duck-chul Lee, PhD,† Jonatan R. Ruiz, PhD,§|| Xuemei Sui, MD,†
 Francisco B. Ortega, PhD,*§ Timothy S. Church, MD, PhD,¶|| Carl J. Lavie, MD,#
 Manuel J. Castillo, MD, PhD,* Steven N. Blair, PED†‡

Granada, Spain; Columbia, South Carolina; Huddinge, Sweden; Baton Rouge and New Orleans, Louisiana

[J Am Coll Cardiol 2011;57:1831-7]



Original Investigation | Nutrition, Obesity, and Exercise

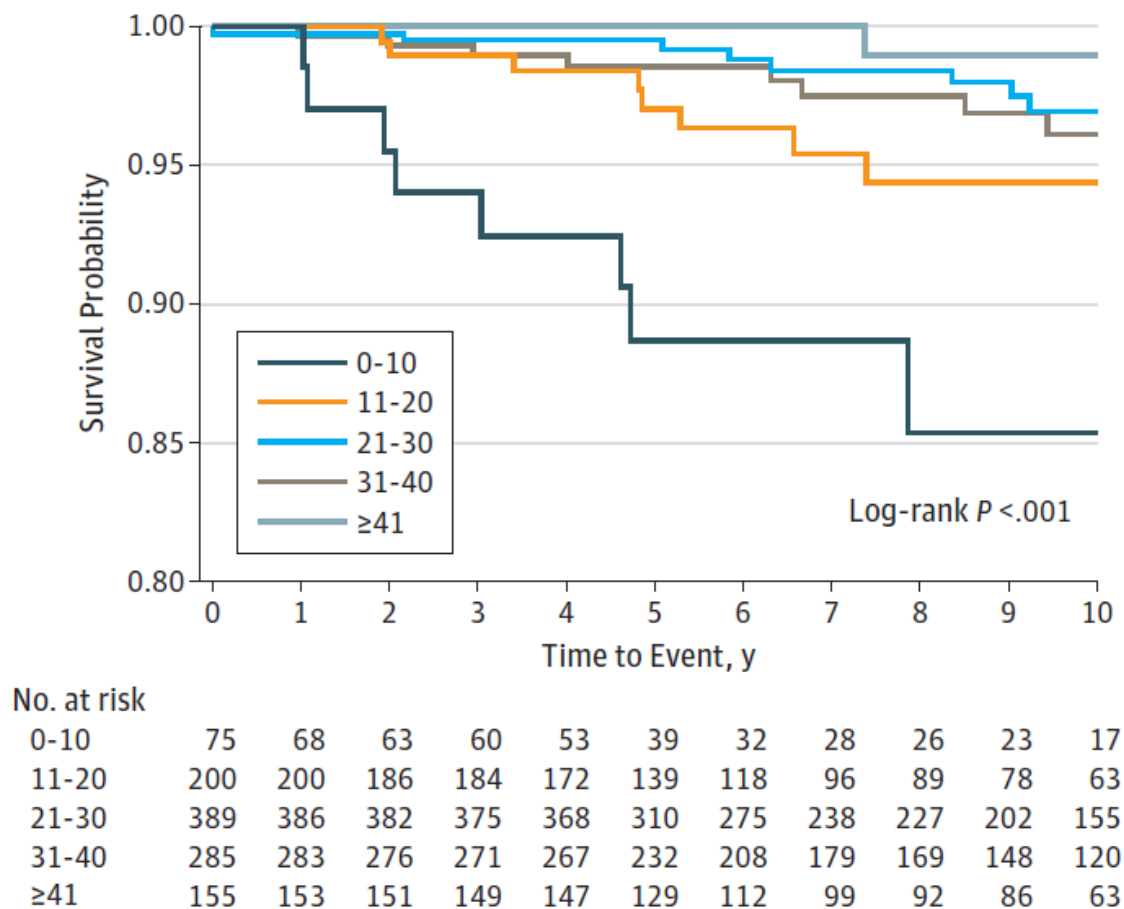
Association Between Push-up Exercise Capacity and Future Cardiovascular Events Among Active Adult Men

Justin Yang, MD, MPH; Costas A. Christophi, PhD; Andrea Farioli, MD, PhD; Dorothee M. Baur, MD, MS; Steven Moffatt, MD; Terrell W. Zollinger, DrPH; Stefanos N. Kales, MD, MPH

CONCLUSIONS AND RELEVANCE The findings suggest that higher baseline push-up capacity is associated with a lower incidence of CVD events. Although larger studies in more diverse cohorts are needed, push-up capacity may be a simple, no-cost measure to estimate functional status.

Association Between Push-up Exercise Capacity and Future Cardiovascular Events Among Active Adult Men

Figure. Kaplan-Meier Curves for the Cumulative Risk of Cardiovascular Disease Outcome in 5 Push-up Categories



Ejercicio & Ateroesclerosis

- Regulación Endotelial
- Resistencia a la Insulina
- Regulación autonómica (TA y FC)
- SIMPATICO (TA y FC—
- LDL pequeñas, HDL 2, TG
- Inflamación crónica
- Hemostasis favorable (?)

Physical Activity and the Prevention of Hypertension

Proposed mechanisms through which physical activity may prevent the development of hypertension.

↓ Vascular Resistance	↑ Endothelial Function
↓ Arterial Stiffness	↑ Insulin Sensitivity/Glucose Handling
↓ Oxidative Stress	↑ Renal Function
↓ Inflammation	↑ Sodium Handling
↓ Body Weight/Body Mass	↑ Baroreflex Sensitivity
↓ Sympathetic Activity	↑ Parasympathetic Activity
↓ Renin-angiotensin System Activity	↑ Angiogenesis
↓ Vascular responsiveness to adrenergic- and endothelin-receptor stimulation	↑ Arteriogenesis
↓ Intima-media thickness	↑ Arterial Compliance
↓ Psychosocial Stress	↑ Arterial lumen diameter

Curr Hypertens Rep. 2013 December ; 15(6): 659–668.

Fuerza de Cuadriceps

Quadriceps Strength as a Predictor of Mortality in Coronary Artery Disease



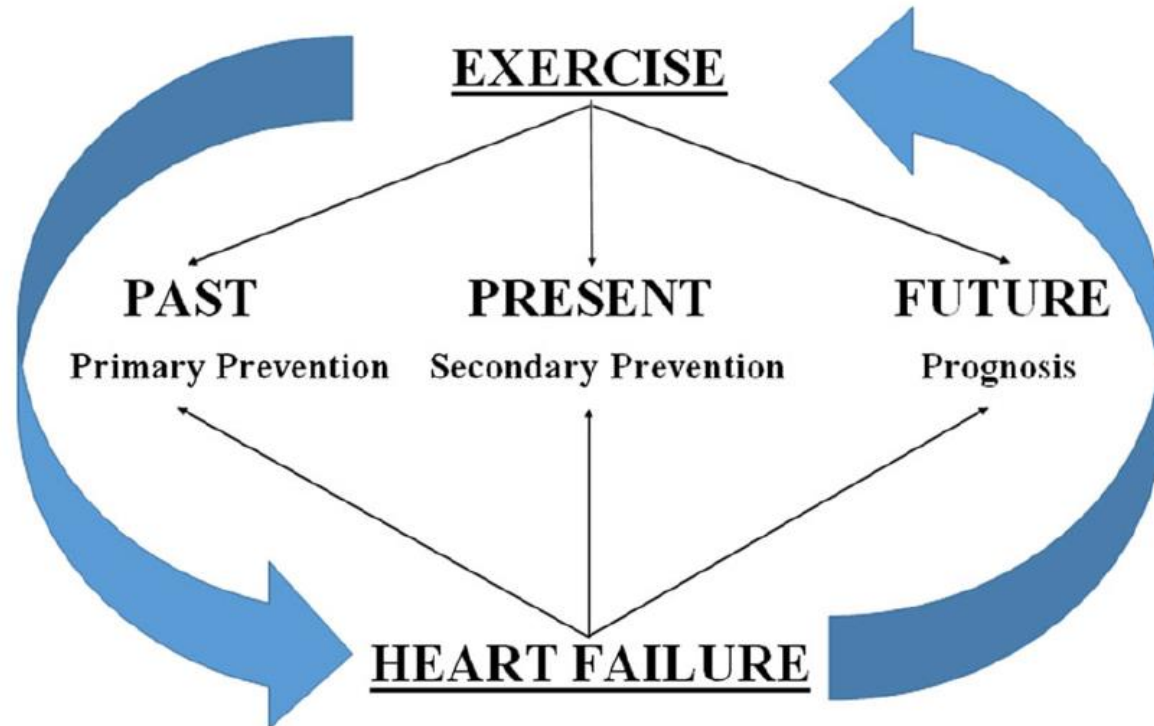
Kentaro Kamiya, PT, PhD,^a Takashi Masuda, MD, PhD,^{b,c} Shinya Tanaka, PT, MSc,^b Nobuaki Hamazaki, PT, MSc,^{a,b} Yuya Matsue, MD, PhD,^d Alessandro Mezzani, MD, FESC,^e Ryota Matsuzawa, PT, PhD,^a Kohei Nozaki, PT, MSc,^a Emi Maekawa, MD, PhD,^f Chiharu Noda, MD, PhD,^f Minako Yamaoka-Tojo, MD, PhD,^{b,c} Yasuo Arai, HIM, MSc,^g Atsuhiko Matsunaga, PT, PhD,^{b,c} Tohru Izumi, MD, PhD,^f Junya Ako, MD, PhD^f



Mortalidad 23% - 34%

Exercise and heart failure: an update

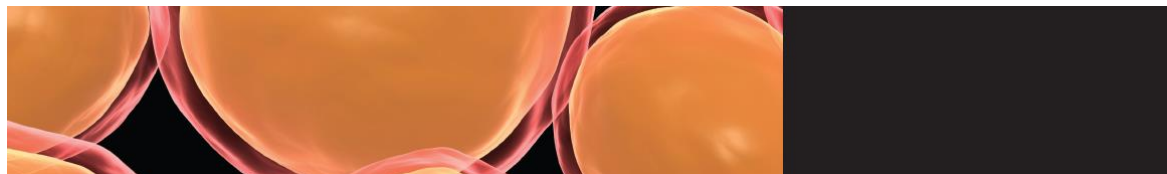
Figure 2 Scheme of interactions between exercise and heart failure in different phases of the disease.





What is Causing the Worldwide Rise in Body Weight?

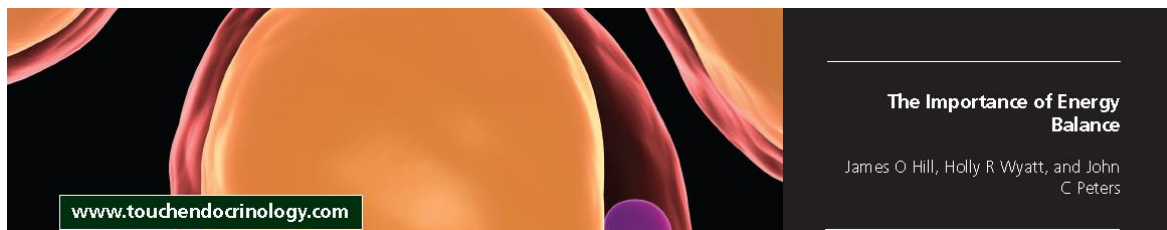
Robin P Shook, PhD,¹ Steven N Blair, PED,² John Duperly, MD, PhD,³ Gregory A Hand, PhD, MPH,⁴
Sandra M Matsudo, MD, PhD⁵ and Joanne L Slavin, PhD, RD⁶



The Importance of Energy Balance

James O Hill, PhD, Holly R Wyatt, MD and John C Peters, PhD

Anschutz Health & Wellness Center, University of Colorado, Aurora, CO



Physical Inactivity



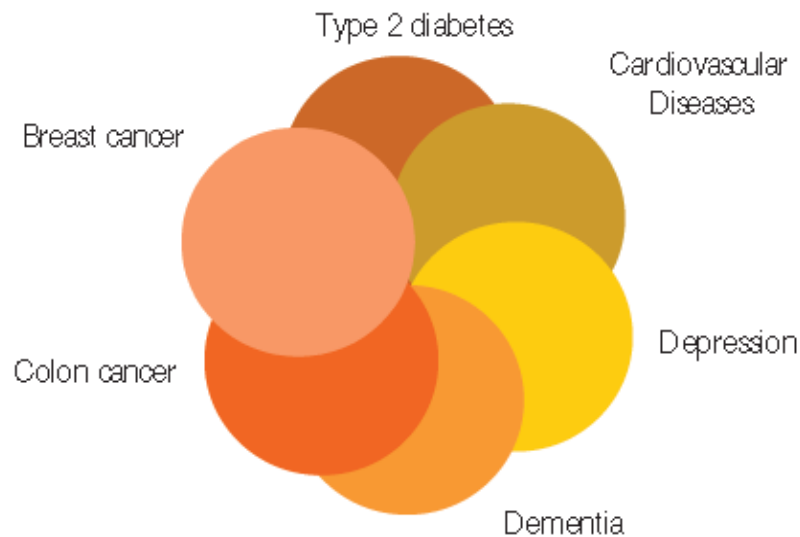
Visceral fat accumulation



Chronic Systemic Inflammation



Insulin Resistance, Atherosclerosis, Neurodegeneration, Tumour growth



Prediabetes en Colombia: Consenso de expertos

Tabla 1. Prevalencia de obesidad abdominal en Colombia. ENSIN 2005 - 2010

Edad (Años)	Obesidad Abdominal		Obesidad Abdominal	
	Hombres ≥ 90 cm		Mujeres ≥ 80 cm	
	2005 (%)	2010 (%)	2005 (%)	2010 (%)
18 a 22	6.6	8.9	18.9	26.7
23 a 27	16.3	22.4	31.5	40.3
28 a 32	28.7	44.0	34.7	54.6
33 a 37	36.1	42.7	52.5	63.5
38 a 42	44.2	59.0	51.6	71.1
43 a 47	46.8	54.0	65.9	75.1
48 a 52	54.1	73.0	58.8	81.3
53 a 57	56.2	59.4	75.8	85.2
58 a 64	55.2	60.7	77.4	84.9
Total	33.8	39.8	51.4	62.0

Fuente ENSIN 2005-2010

ENSIN: Encuesta Nacional de Situación Nutricional en Colombia 2010

Prediabetes en Colombia: Consenso de expertos

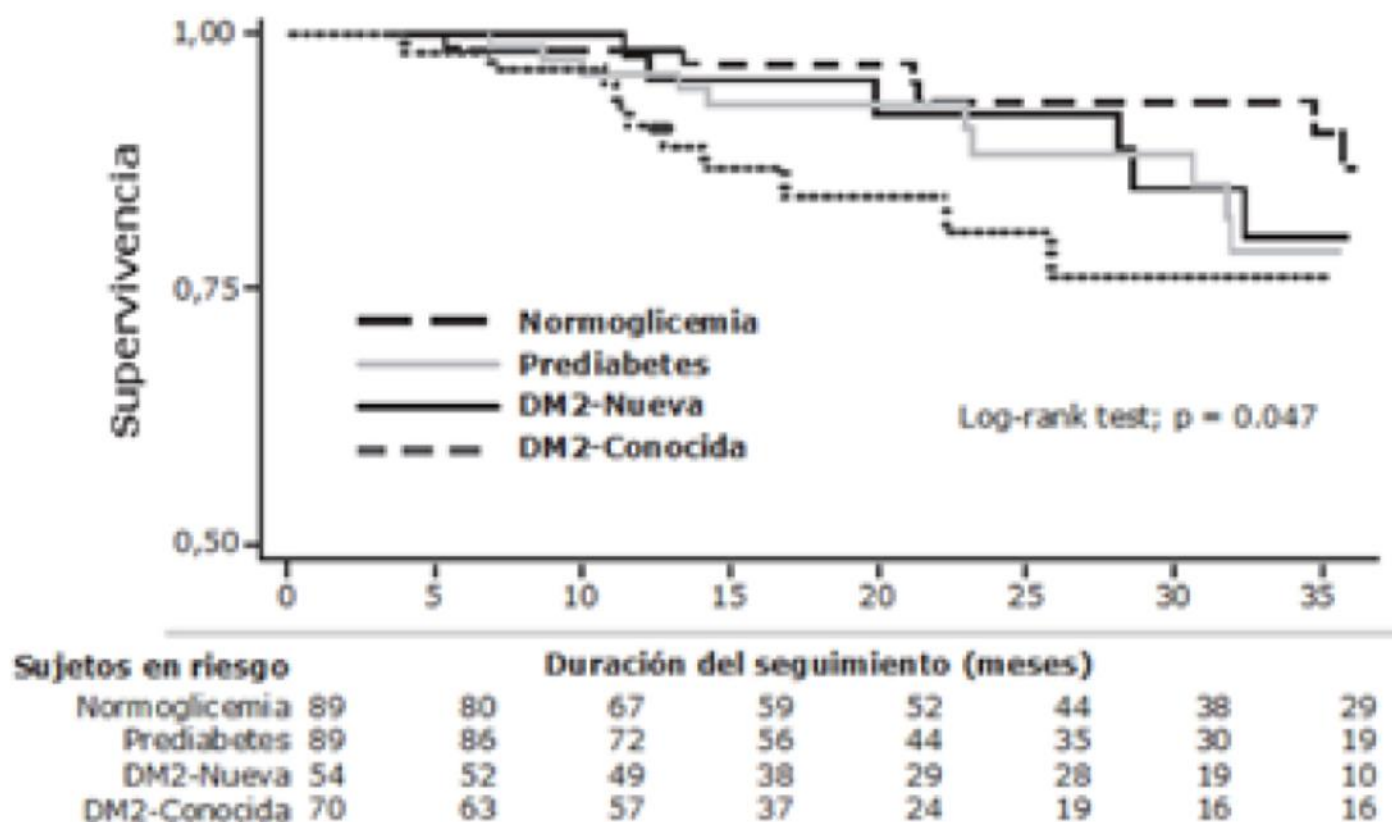
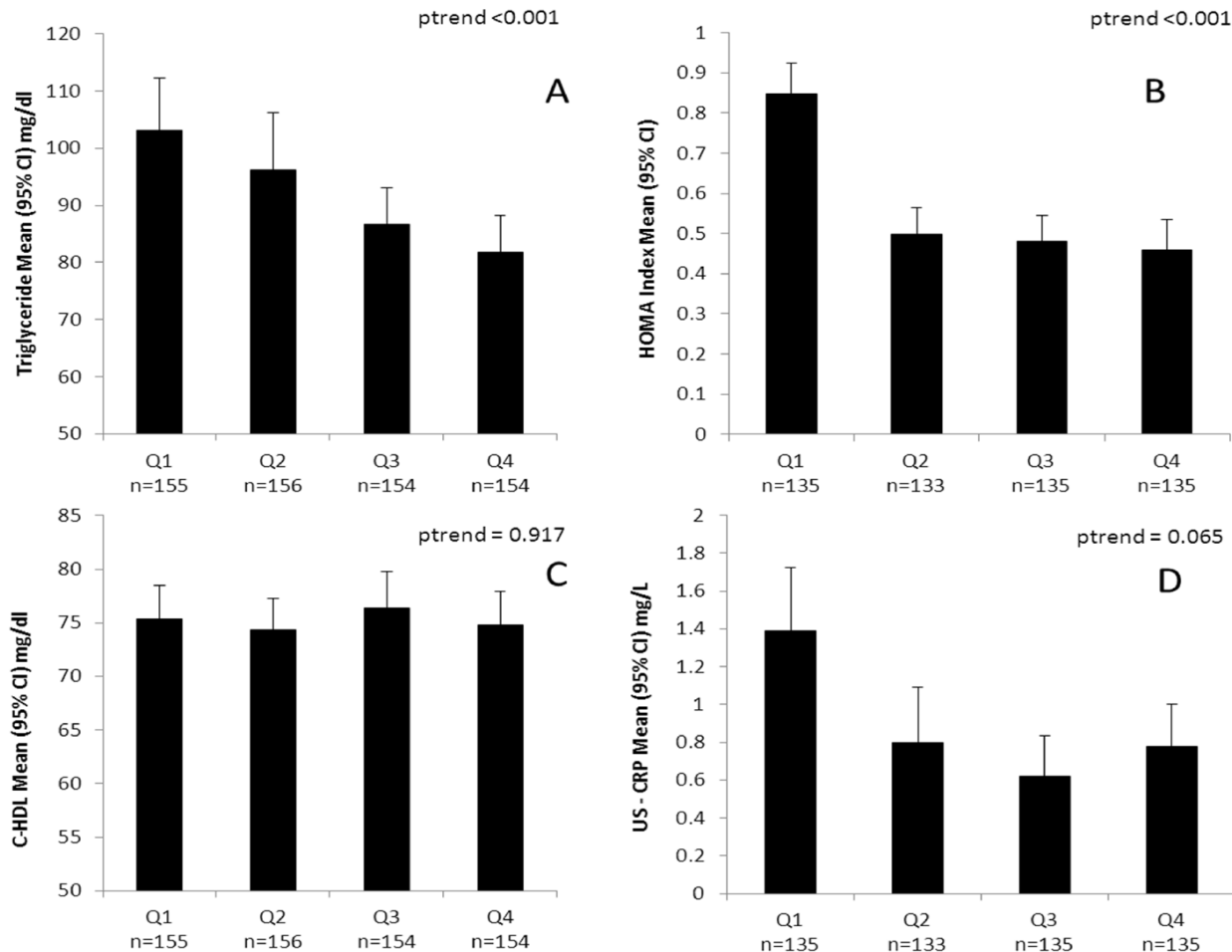


Figura 2. Supervivencia de pacientes colombianos luego de un primer infarto de miocardio por estado de glucemia evaluada al momento del alta hospitalaria

Low Muscle Strength Is Associated with Metabolic Risk Factors in Colombian Children: The ACFIES Study

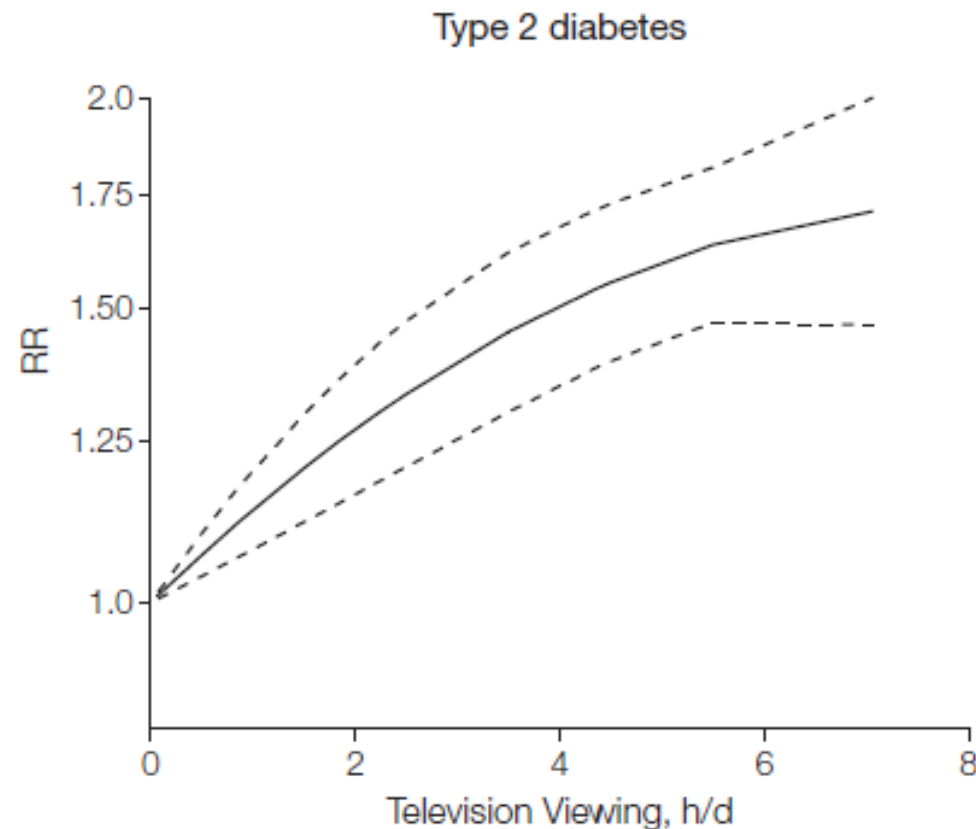
Daniel Dylan Cohen^{1,2}, Diego Gómez-Arbeláez^{1,2}, Paul Anthony Camacho¹, Sandra Pinzon², Claudia Hormiga¹, Juanita Trejos-Suarez², John Duperly³, Patricio Lopez-Jaramillo^{1,2*}



Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality

A Meta-analysis

Figure 3. Dose-Response Relationship Between Tele



JAMA. 2011;305(23):2448-2455

Lifestyle Risk Factors and New-Onset Diabetes Mellitus in Older Adults

The Cardiovascular Health Study

Dariusz Mozaffarian, MD, DrPH; Aruna Kamineni, MPH; Mercedes Carnethon, PhD;
Luc Djoussé, MD, ScD; Kenneth J. Mukamal, MD; David Siscovick, MD, MPH

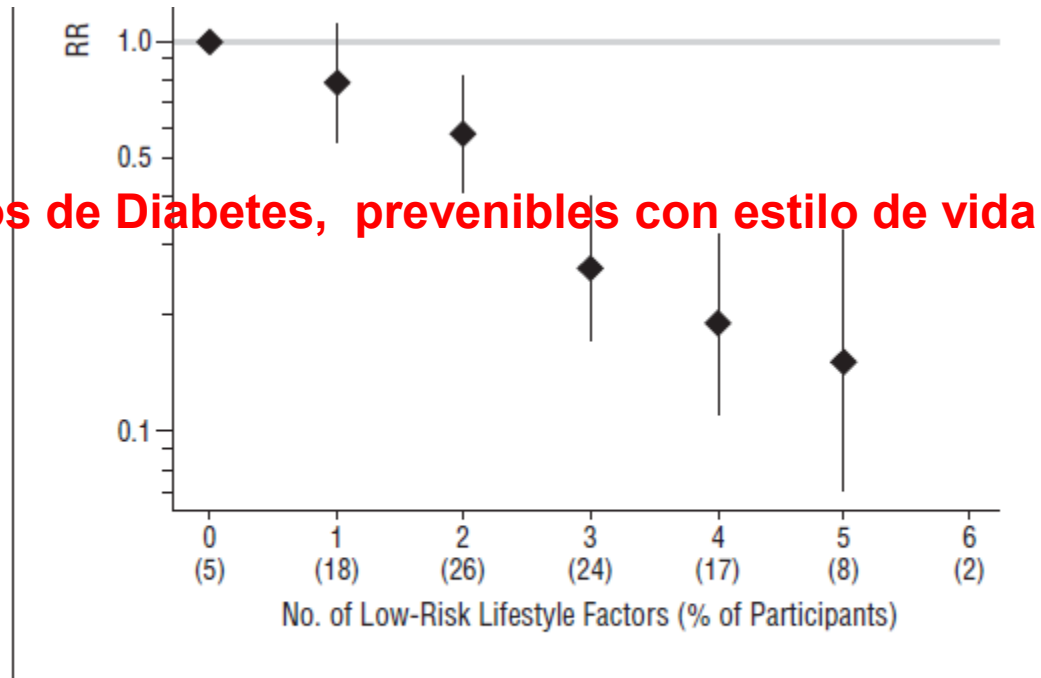
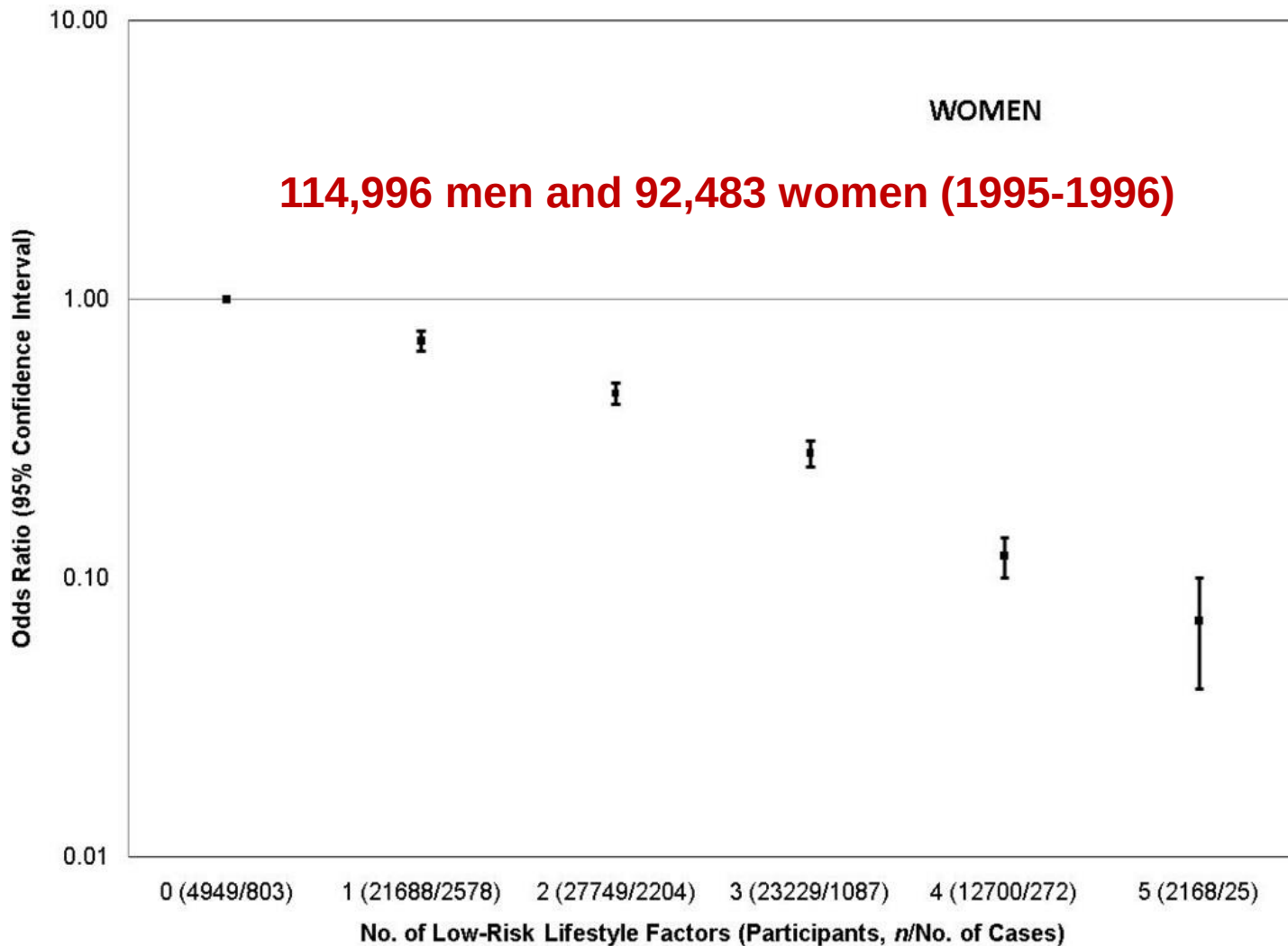


Figure 1. Relative risk (RR) of incident diabetes mellitus according to the number of low-risk lifestyle factors among 4883 older adults from 1989 to 2000

Lifestyle Factors and Risk for New-Onset Diabetes in a Large Population-Based Prospective Cohort Study



Physical Activity and Mortality in Individuals With Diabetes Mellitus

A Prospective Study and Meta-analysis

Conclusions: Higher levels of PA were associated with lower mortality risk in individuals with diabetes. Even those undertaking moderate amounts of activity were at appreciably lower risk for early death compared with inactive persons. These findings provide empirical evi-

Physical Activity and Mortality in Individuals With Diabetes Mellitus

A Prospective Study and Meta-analysis

Arch Intern Med. 2012;172(17):1285-1295.

HR (95% CI)

0.61 (0.40-0.92)

0.84 (0.48-1.47)

0.45 (0.31-0.66)

0.73 (0.57-0.94)

0.63 (0.49-0.80)

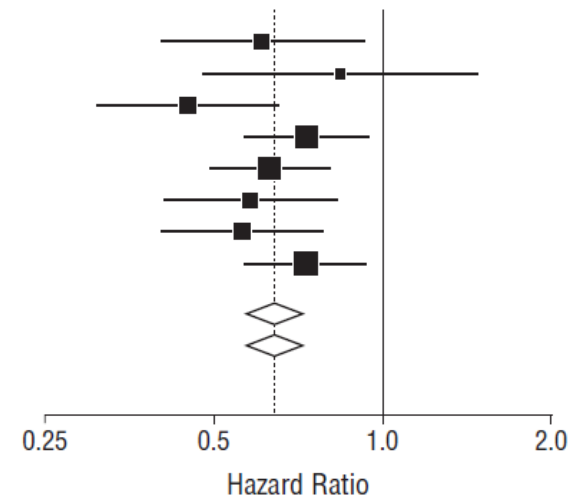
0.58 (0.41-0.83)

0.56 (0.40-0.78)

0.73 (0.57-0.93)

0.64 (0.57-0.72)

0.64 (0.57-0.72)



HR (95% CI)

0.39 (0.21-0.72)

1.35 (0.49-3.71)

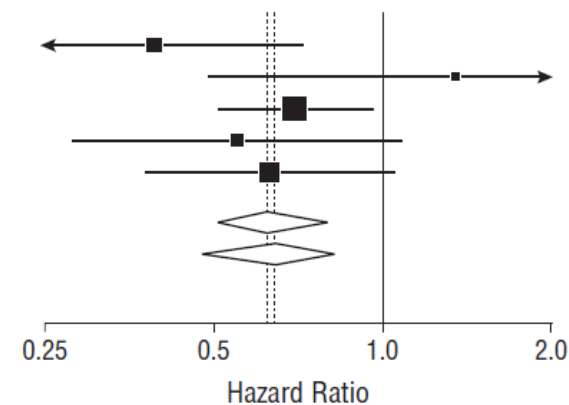
0.70 (0.51-0.96)

0.55 (0.28-1.08)

0.63 (0.38-1.04)

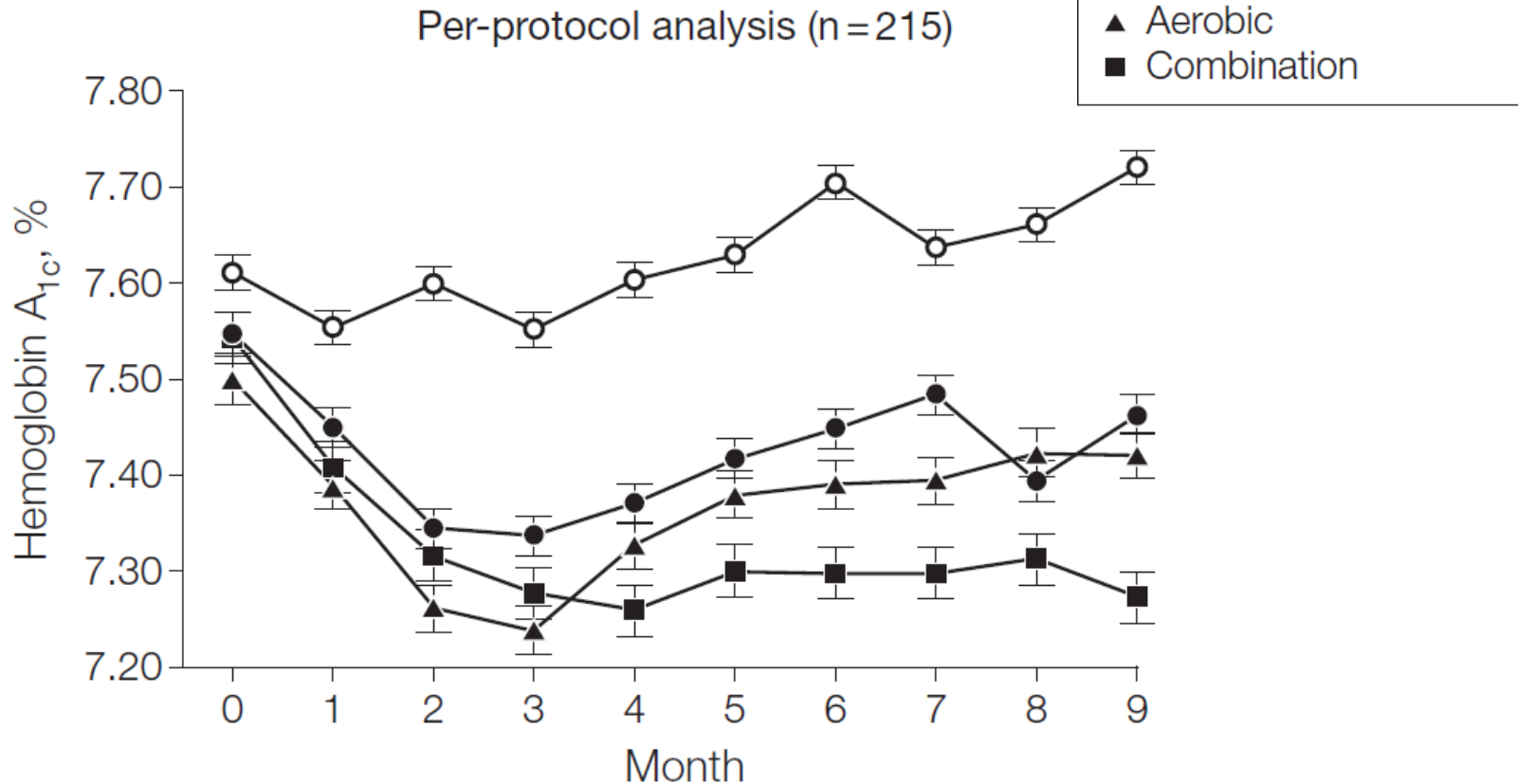
0.64 (0.51-0.80)

0.63 (0.48-0.83)



Effects of Aerobic and Resistance Training on Hemoglobin A_{1c} Levels in Patients With Type 2 Diabetes

A Randomized Controlled Trial



Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis

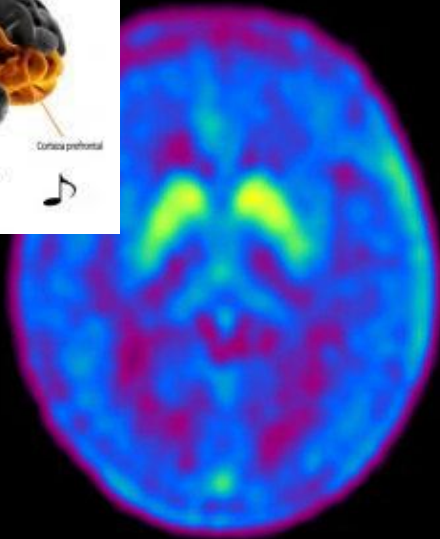
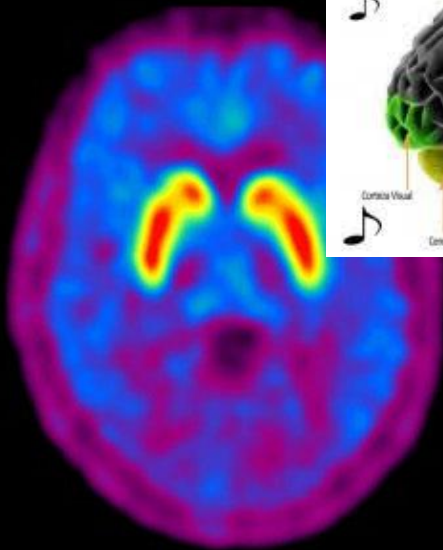
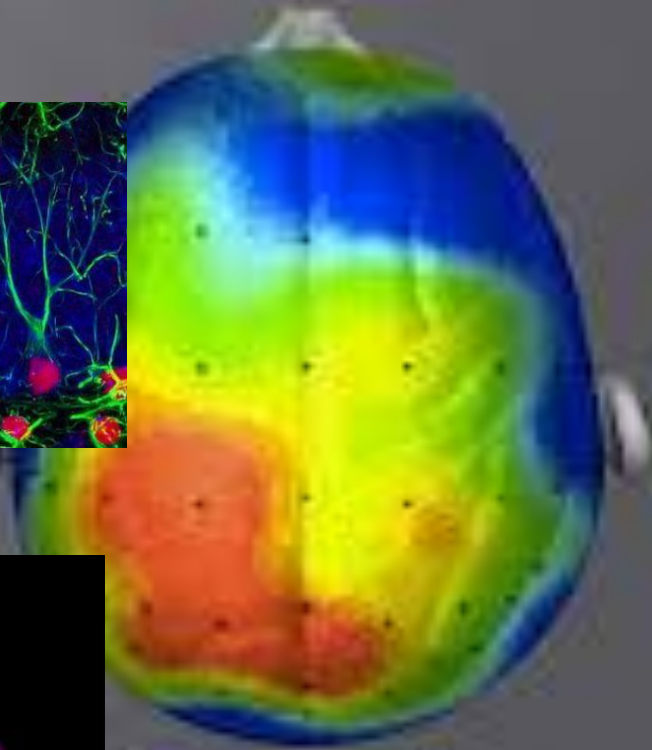
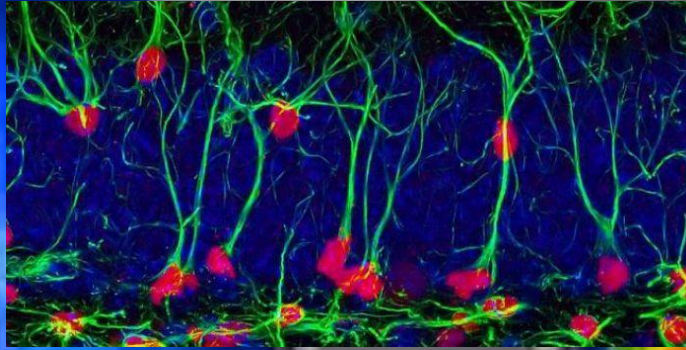
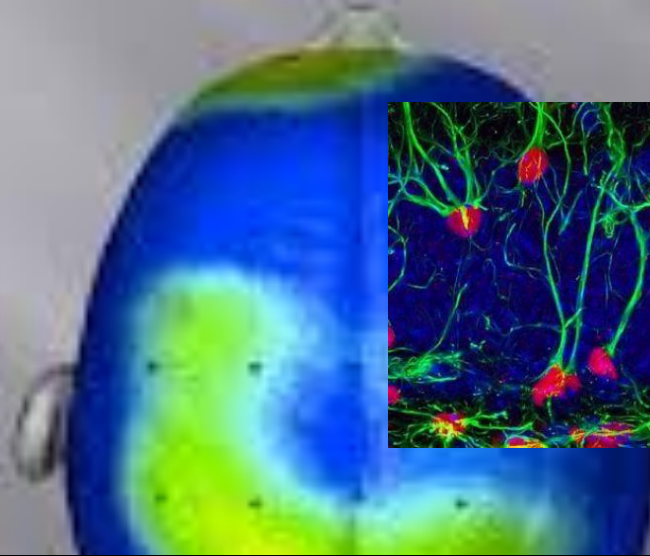
DATA SYNTHESIS: Of 4191 articles retrieved, **47 RCTs (8538 patients)** were included. Pooled mean differences in **HbA(1c)** levels between intervention and control groups were calculated using a random-effects model.

CONCLUSIONS: Structured exercise training (aerobic exercise, resistance training, or both) is associated with HbA(1c) reduction in patients with DM2.

Structured exercise training of >150 min/week is associated with greater HbA(1c) declines. Physical activity advice is associated with lower HbA(1c), but only when combined with dietary advice.

BRAIN AFTER SITTING
QUIETLY

BRAIN AFTER 20 MINUTE
WALK



Exercise training increases mitochondrial biogenesis in the brain.

J Appl Physiol October 2011 111:(4)

Does vigorous exercise have a neuroprotective effect in Parkinson disease?

Neurology[®] 2011;77:288-294

Facilitated physical activity as a treatment for depressed adults: randomised controlled trial

BMJ 2012;344:e2758

CLINICS 2012;67(6):653-659

DOI:10.6061/clinics/2012(06)17

REVIEW

Is exercise an alternative treatment for chronic insomnia?

Physical Exercise as a Preventive or Disease-Modifying Treatment of Dementia and Brain Aging

“A rapidly growing literature strongly suggests that exercise, specifically aerobic exercise, may attenuate cognitive impairment and reduce dementia risk”

- Inducción de Factores Neurotróficos Protectores
- Mitigación de Enf. Macro/Micro Vascular

Mayo Clin Proc. 2011;86(9):876-884

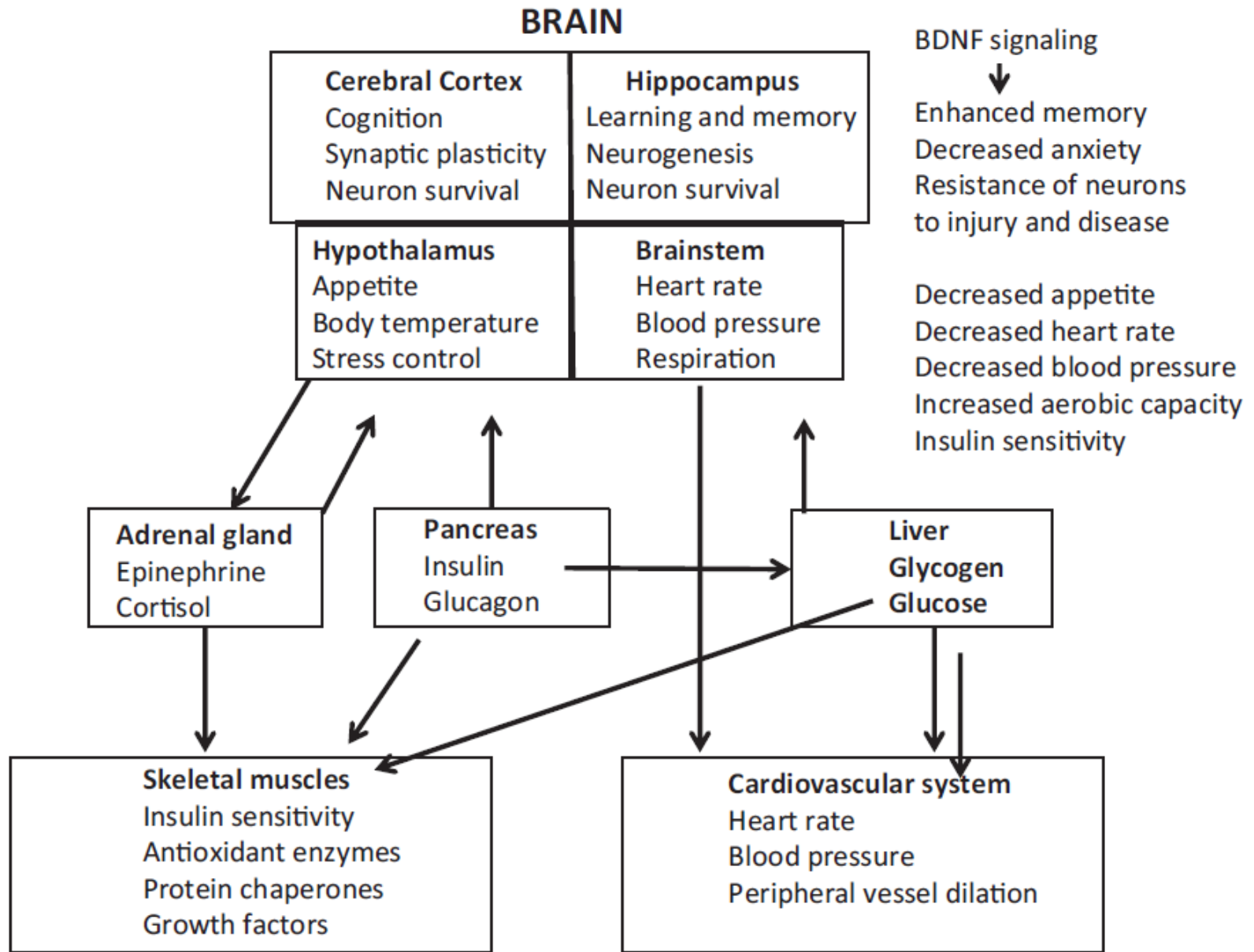


Fig. 2. Brain-derived neurotrophic factor (BDNF) is an integrator of adaptive responses of the brain and body to endurance running.

The effectiveness of exercise as an intervention in the management of depression: systematic review and meta-regression analysis of randomised controlled trials

Debbie A Lawlor, Stephen W Hopker

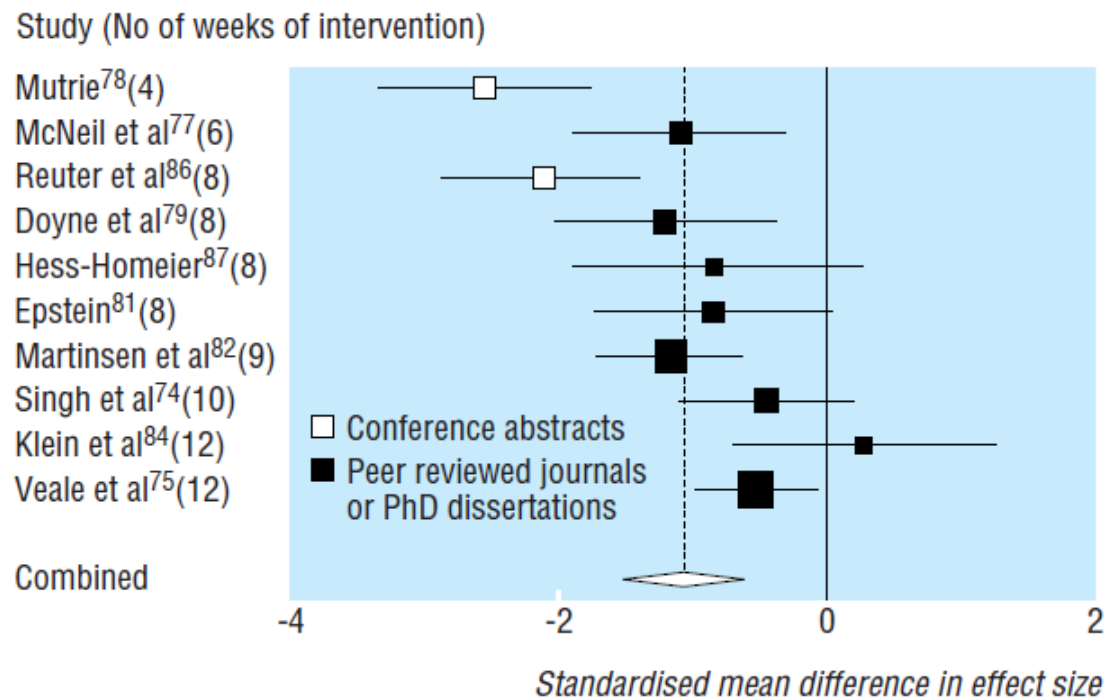


Fig 2 Standardised mean difference in size of effect of exercise compared with “no treatment” for depression

Review

Exercise and the treatment of depression: A review of the exercise program variables

Conclusions: There is evidence for the use supervised aerobic exercise, undertaken three times weekly at moderate intensity for a minimum of nine weeks in the treatment of depression. Further research on the manipulation of program variables is warranted.

Hay evidencia sobre los beneficios del ejercicio aeróbico supervisado, de intensidad moderada, 3 veces por semana por mas de 9 semanas para el tratamiento de la depresión.

Journal of Science and Medicine in Sport 17 (2014) 177–182

Review

Physical activity and brain development

Efectos favorables sobre el desarrollo cerebral pre y post natal

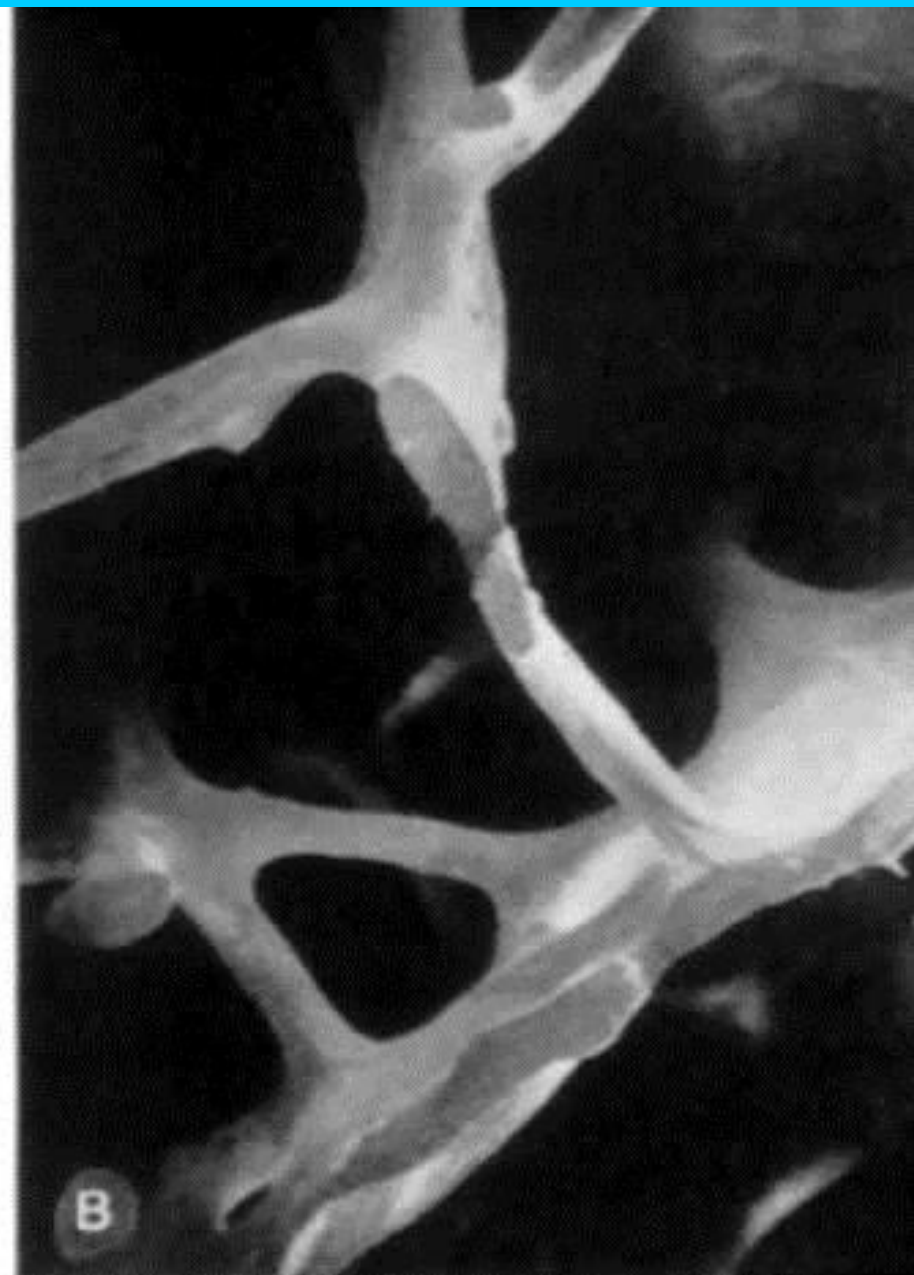
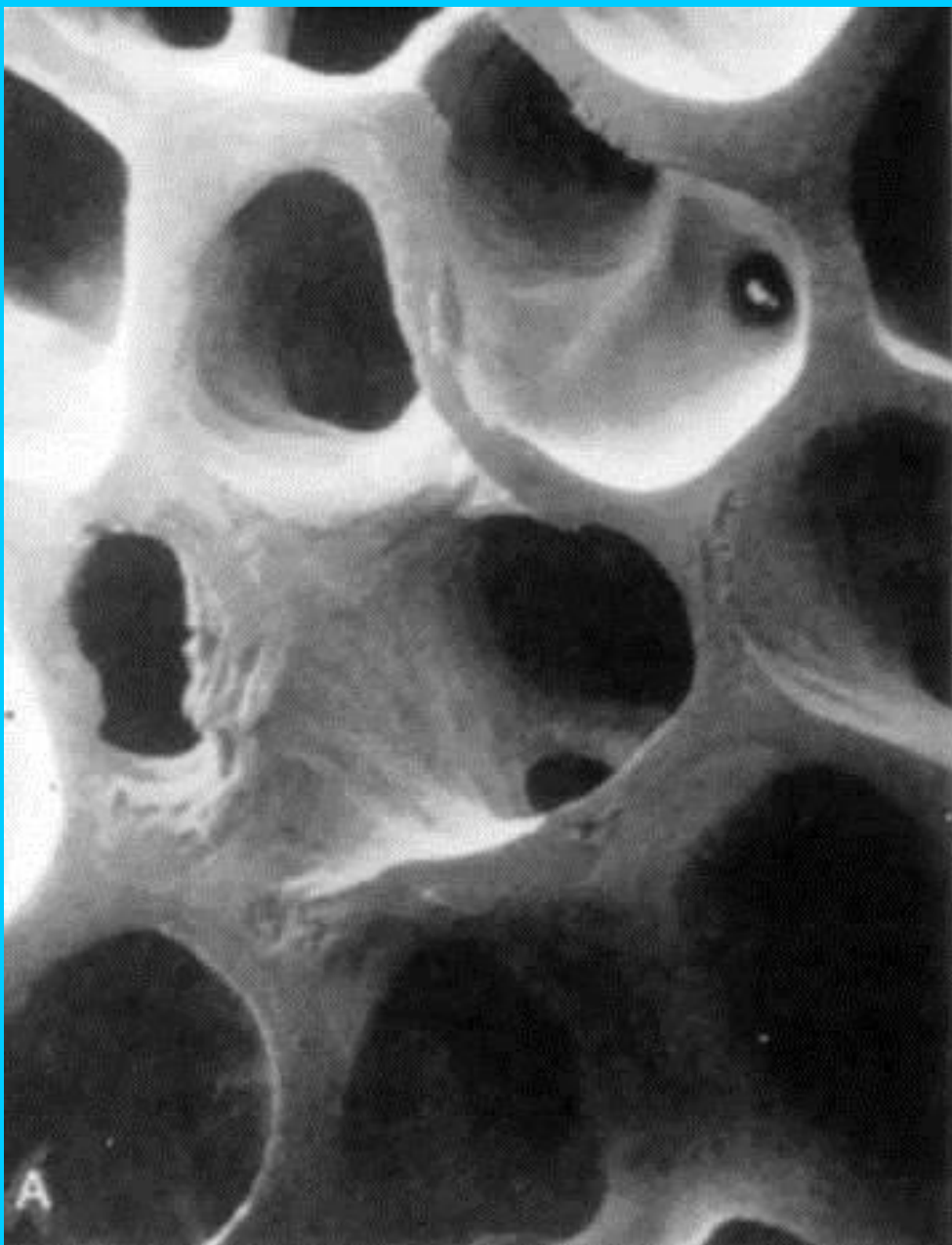
El Ejercicio Materno mejora el desempeño cognitivo en la infancia

Ejercicio en la infancia y la adolescencia mejora el aprendizaje y los “socres” de inteligencia.

El ejercicio induce efectos profundos en proliferación (BDNF) y supervivencia celular en la progenie de madres ejercitadas durante la the adolescencia.

Journal Expert Review of Neurotherapeutics
Volume 15, 2015 - Issue 9





The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors: a systematic review and implementation recommendations

Physical Activity and Exercise

Effect on bone mass and density **A**

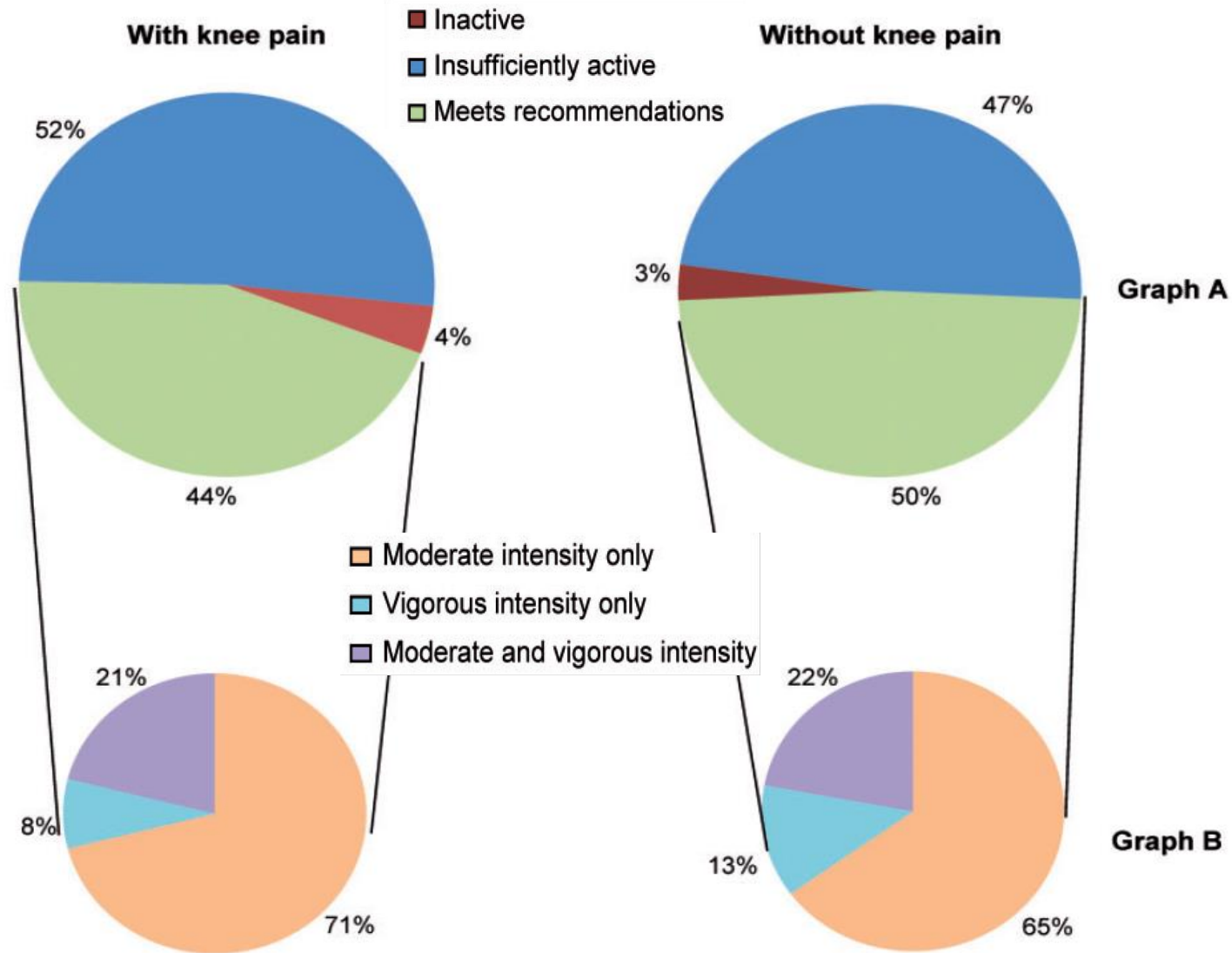
Effect on bone structural outcomes **B**

Factors influencing physical activity in patients with early rheumatoid arthritis: A mixed-methods study

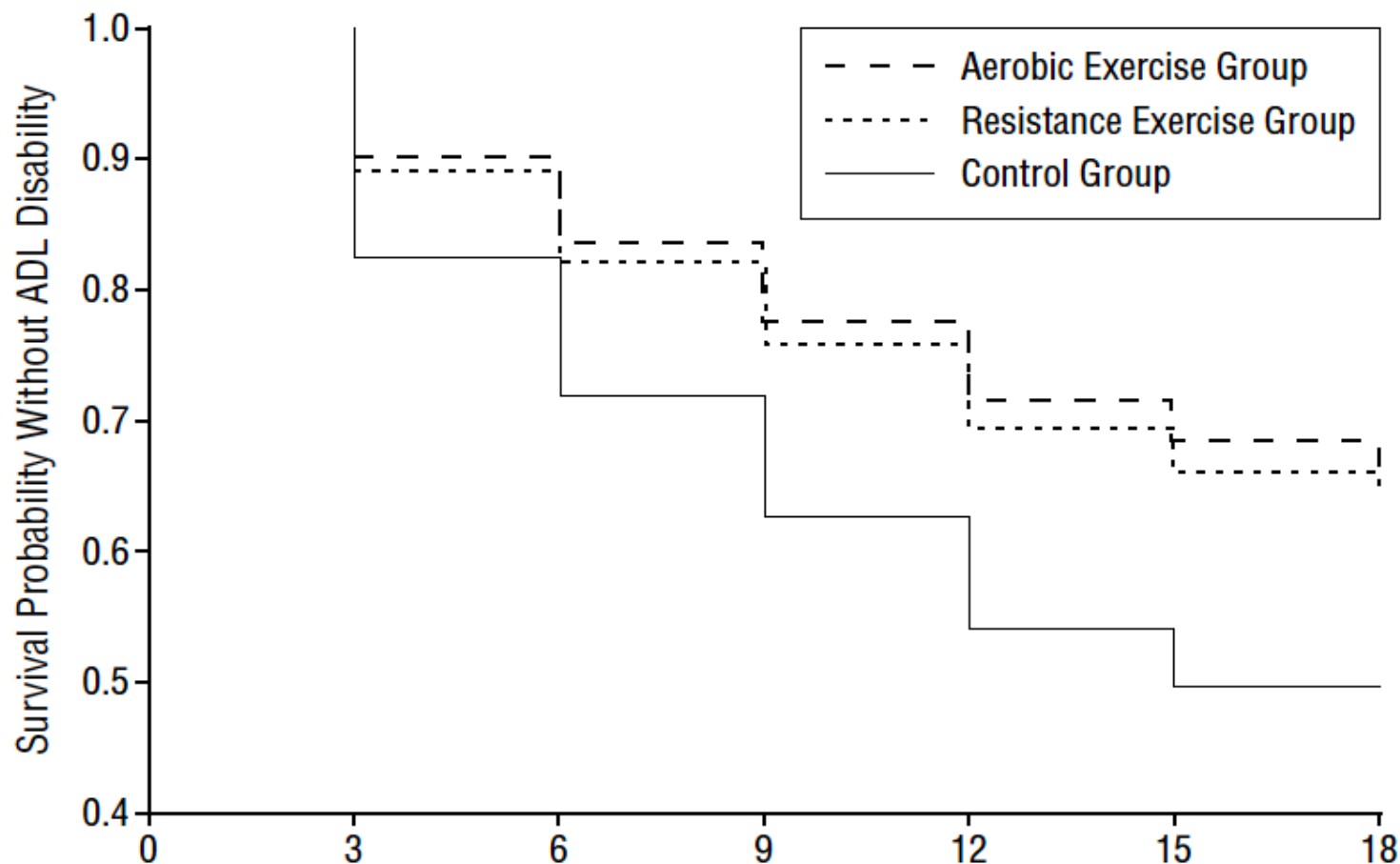
In order to provide more effective health interventions, it is important to consider the complex nature of practicing PA, where a person-centred approach should be considered.

Para lograr intervenciones mas efectivas debemos considerar la naturaleza compleja de practicar actividad física, debemos considerar abordajes **centrados en la persona.**

Exercise and physical activity in older adults with knee pain: a mixed methods study



Physical Exercise and the Prevention of Disability in Activities of Daily Living in Older Persons With Osteoarthritis



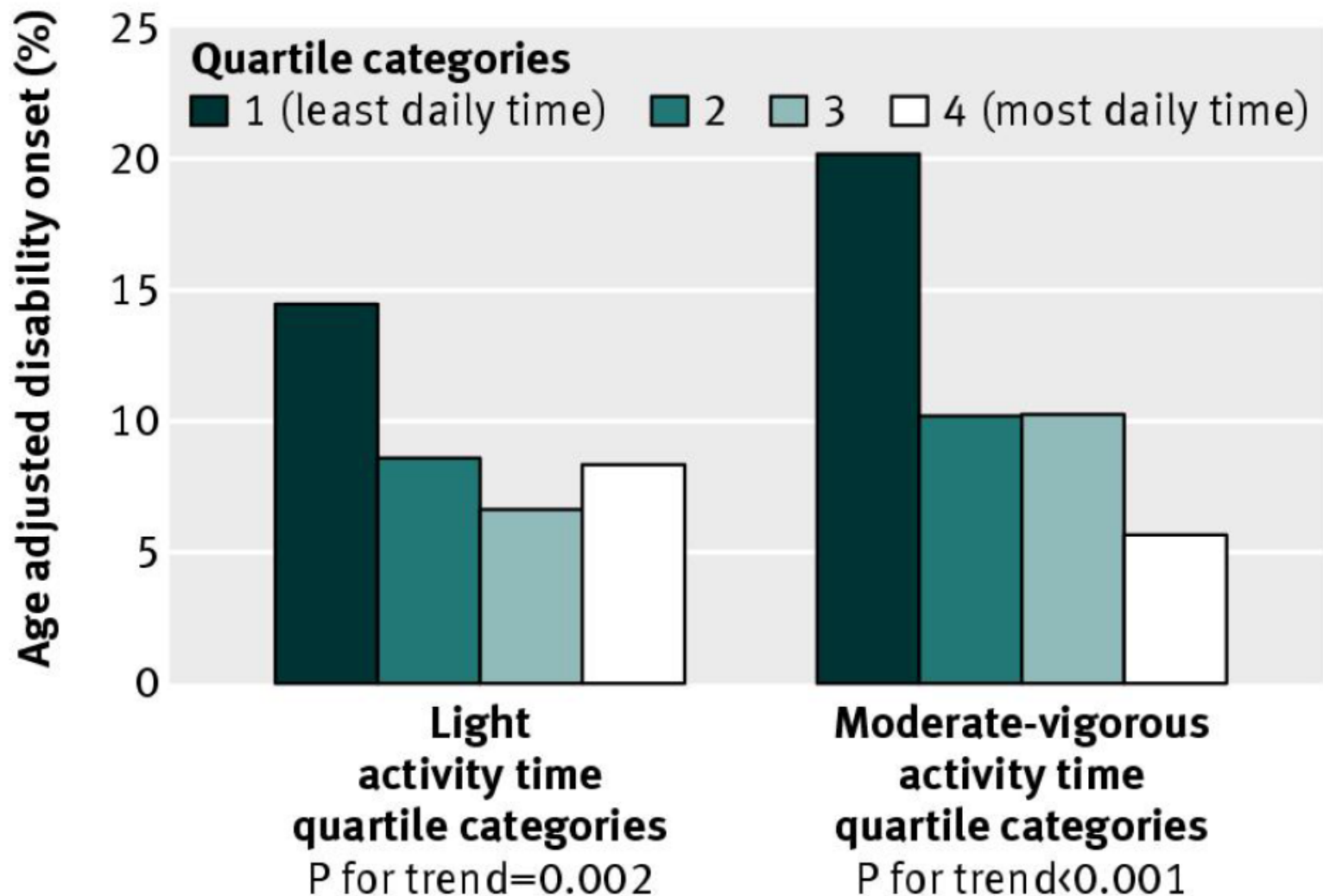


Fig 2 Age adjusted percentage of incident disability according to quartile categories of light physical activity and moderate-vigorous physical activity (n=1680)

JOHN DUPERLY

MEDICINA INTERNA - PHD MEDICINA DEL DEPORTE

VIDA SALUDABLE

DEPORTISTAS

ENFERMEDADES

RECURSOS

BLOG

FAQ

PERFIL



blog | Salud e industria, un dilema complejo

Es cierto que con frecuencia nos resulta difícil tomar decisiones éticas y coherentes en nuestra relación personal y profesional con la industria. En nuestra práctica cotidiana, los médicos nos dedicamos a comprender el [...Leer más](#)



MedRun 2014 – 10 años de Medicina en Uniandes

NOTICIAS

Una carrera por la educación de los niños de Choachí. EPIC TRAIL CHOACHÍ es la primera carrera atlética de montaña [...Leer más](#)

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MUERTES GLOBALES ATRIBUIDAS A LOS 6 PRINCIPALES FACTORES DE RIESGO POR NIVEL DE INGRESOS



The Ottawa Panel Clinical Practice Guidelines for the Management of Knee Osteoarthritis. Part Two: Strengthening Exercise Programs

Conclusion: There are a variety of choices for strengthening exercise programs with positive recommendations for healthcare professionals and knee osteoarthritis patients. There is a need to develop combined behavioral and muscle-strengthening strategies to improve long-term maintenance of regular strengthening exercise programs.

Existe una variedad de ejercicios de fortalecimiento para pacientes con Osteoartritis. Se deben combinar estrategias comportamentales y de fortalecimiento...

Review Clin Rehabil, 31 (5), 596-611 May 2017

A systematic review and meta-analysis of adherence to physical activity interventions among three chronic conditions: cancer, cardiovascular disease, and diabetes

Conclusions: The current evidence suggests that people with chronic conditions are capable of sustaining aerobic physical activity for 3+ months, as a form of treatment. Moreover, home-based programs may be just as feasible as supervised, clinic-based physical activity programs.

La evidencia sugiere que las personas con enfermedades crónicas son capaces de sostener actividad física aeróbica por mas de 3 meses como parte del tratamiento.

Los programas domiciliarios podrían ser tan factibles como los programas clínicos supervisados.

Promoting physical activity to patients

Box 1: Common barriers to increasing physical activity¹⁸⁻²¹

- Lack of motivation
- Lack of leisure time
- Lack of money
- Lack of transport
- Illness or disability
- Perceived lack of benefit
- Lack of provision of open spaces in environment
- Lack of safe places to exercise
- Lack of physical activity culture in ethnic group
- Fear of racial or religious discrimination

Motivación
Tiempo libre
Dinero
Transporte
Discapacidad
Beneficios percibidos
Seguridad
Cultura/Etnia
Religión

Prescripción del ejercicio



**Una guía para recomendar
actividad física a cada paciente**

John Duperly, MD, PhD
Felipe Lobelo, MD, PhD



John Duperly es director del Centro Regional de Exercise is Medicine® (EIM®) América Latina. Es especialista en Medicina Interna y PhD en Medicina del Deporte, miembro institucional de la Fundación Santa Fe de Bogotá y profesor asociado de la Facultad de Medicina de la Universidad de Los Andes. Es representante del Presidente de la República de Colombia ante el Consejo Nacional del Deporte, la Recreación, la Actividad Física y el Aprovechamiento del Tiempo Libre.

Felipe Lobelo es profesor asociado del Departamento de Salud Global de la Escuela de Salud Pública de la Universidad de Emory y vicepresidente del Comité de Actividad Física de la Asociación Americana del Corazón (AHA). Es autor de más de 60 publicaciones científicas y miembro de la junta asesora de la iniciativa global EIM® del Colegio Americano de Medicina del Deporte (ACSM), del cual es director de su Centro Global de Investigación y Colaboración.

Routine Assessment and Promotion of Physical Activity in Healthcare Settings

A Scientific Statement From the American Heart Association

adult patients. It also adds concrete recommendations for healthcare systems, clinical and community care providers, fitness professionals, the technology industry, and other stakeholders in order to catalyze increased adoption of physical activity assessment and promotion in healthcare settings and to contribute to meeting the American Heart Association's 2020 Impact Goals.

Felipe Lobelo, MD, PhD,
FAHA, Chair

Deborah Rohm Young,
PhD, FAHA, Vice Chair

Robert Sallis, MD

Michael D. Garber, MPH

Sandra A. Billinger, PT,
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Mayor información
Inscripciones@fsfb.edu.com
Tel. 6030303 Ext. 5725 - 5749
www.fsfb.edu.co

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