Wellness aspects of physical fitness: How the physiology of exercise improves physical health, mental health and quality of life

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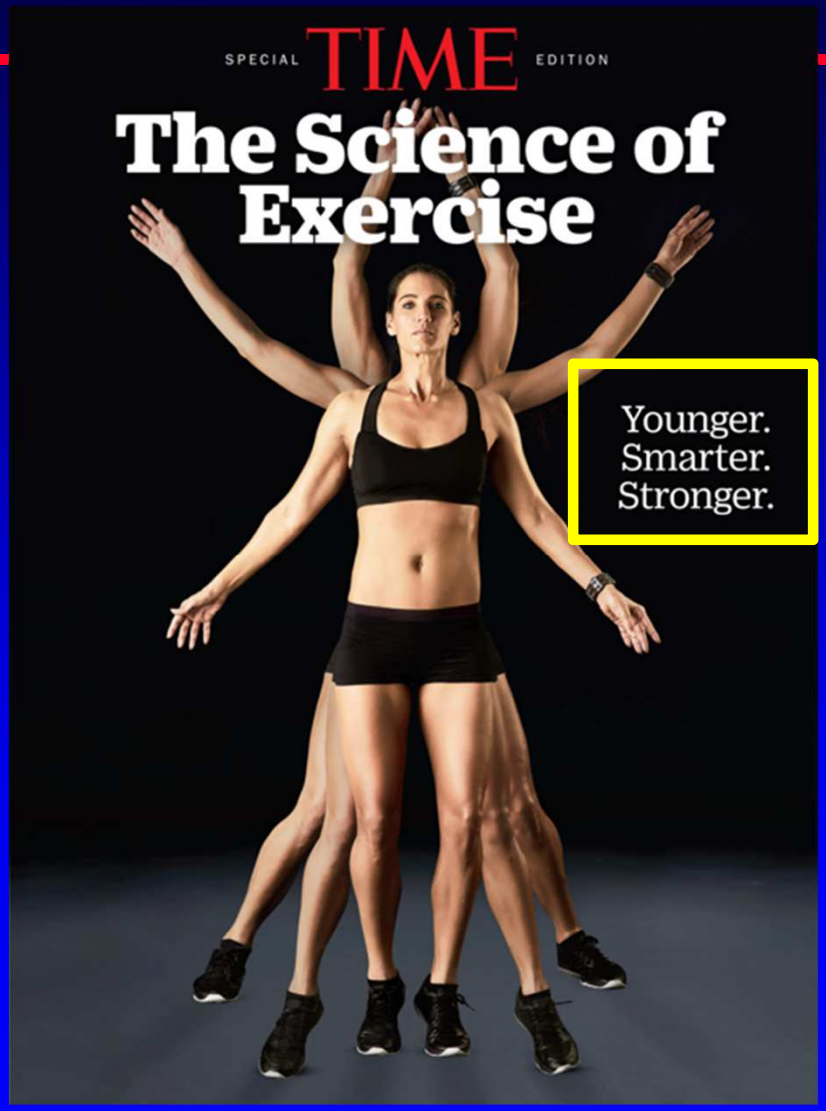
- I will make no references to unlabeled drug use or unapproved drugs.

- I have no disclosures

- Except that I'm a pediatric cardiologist not a PhD in exercise science

- Clinical information about the benefits of exercise

- 1) Adult data
- 2) Pediatric data
- 3) Congenital heart disease data



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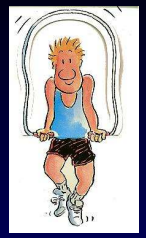

Exercise Benefits

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*

Table 1. Health Benefits of Regular Exercise

Decreased all-cause mortality
Lengthened life span
Decreased morbidity/mortality from cardiovascular disease
Moderated blood pressure
Decreased total cholesterol and LDL cholesterol
Increased HDL cholesterol
Decreased triglycerides
Improved weight management
Decreased incidence and severity of arthritis
Improved bone density
Improved cardiorespiratory response
Improved control of diabetes/glucose metabolism

HDL = high-density lipoprotein; LDL = low-density lipoprotein.

- Stroke**
- Cancer risk reduction
  - Colon, breast
  - Some evidence for
    - Endometrial, lung and pancreatic ***
- Dementia
- Some evidence for improved quality of life

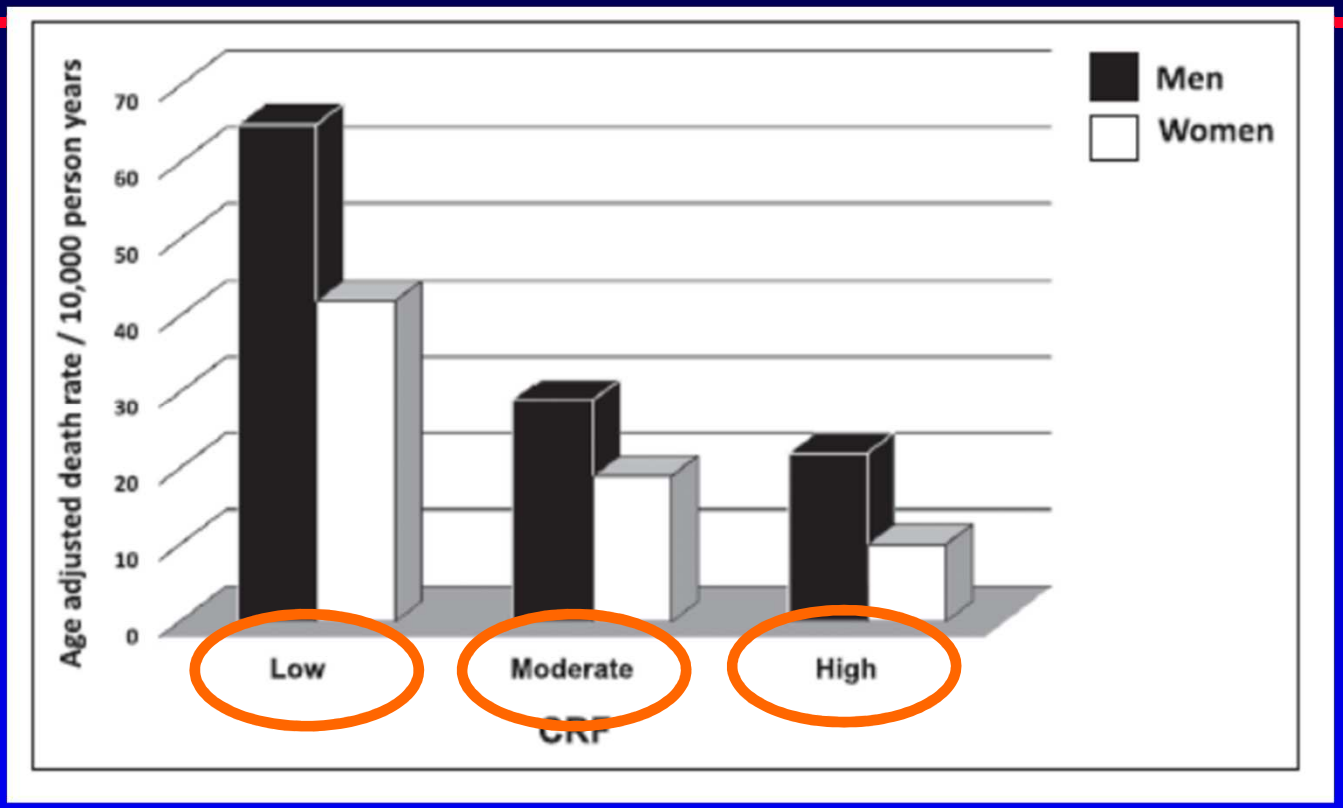
*Harsha: *Am J Med Sci*; 1995(310)S109-113

**Gleeson: *Nature Reviews*; 2011 (11)607-615 ***Walsh: *Exerc Immunol Rev*; 2011 (17)6-63

Adults: All Cause Mortality vs Cardiorespiratory Fitness

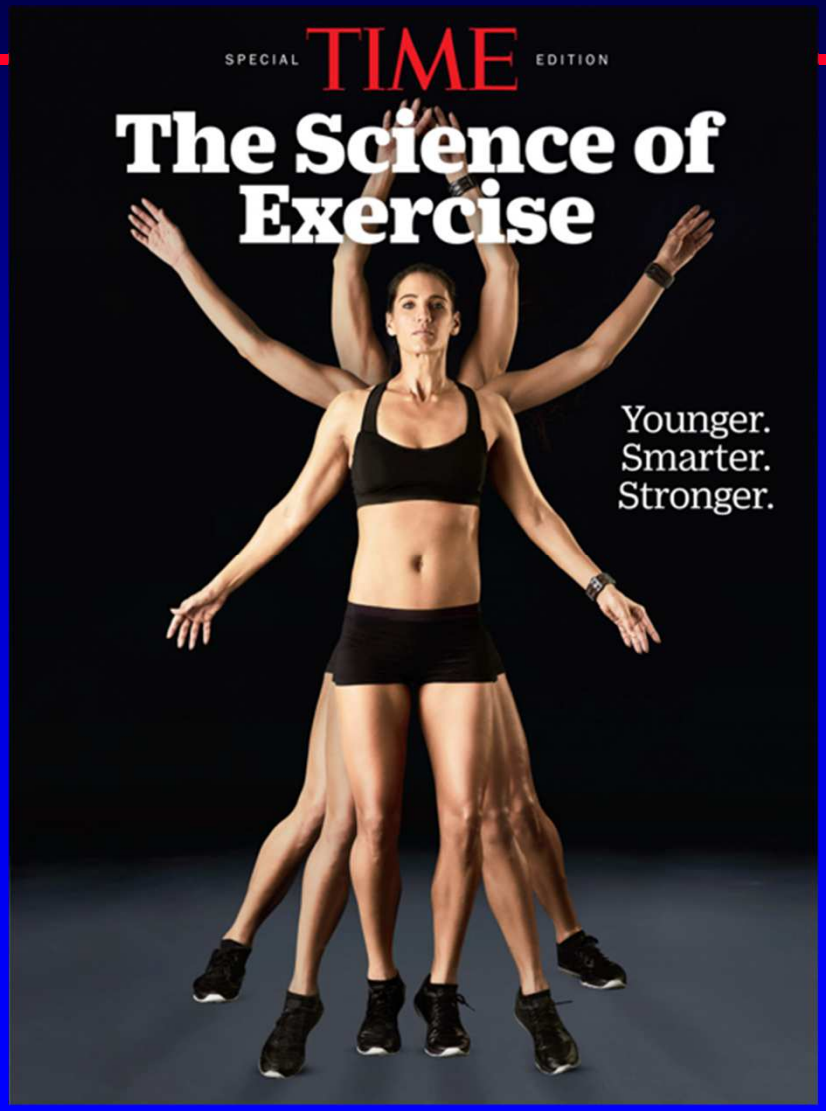
Phoenix Children's Hospital

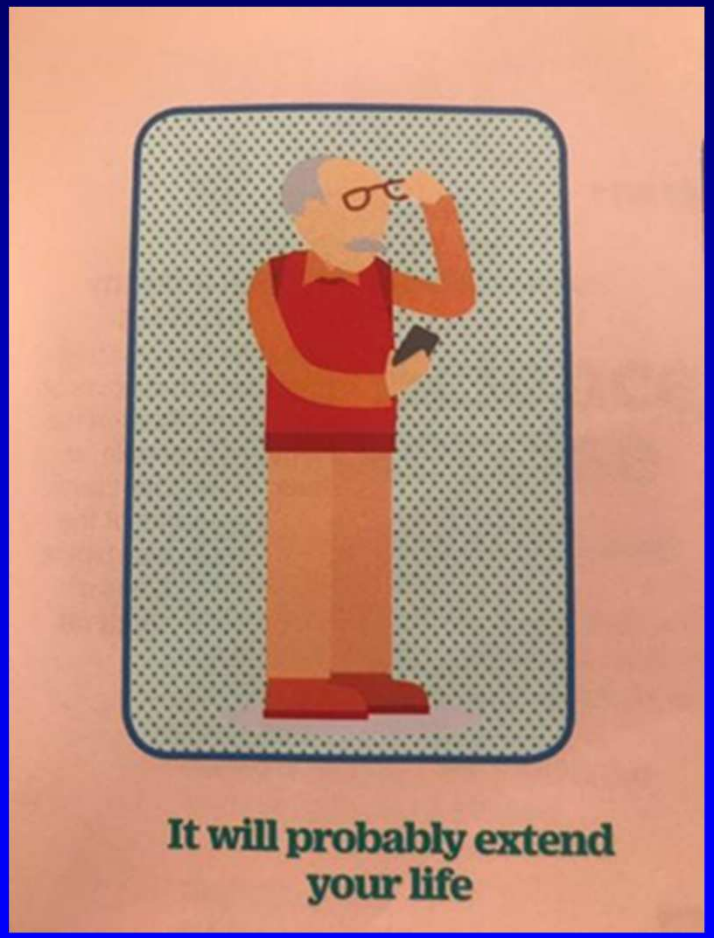
Mortality Rate



- **1989 study: 10,224 men and 3,120 women**
- **Followed > 8 years**
- **Separate study: Each 1 MET increase in CRF was associated with an 10-25% improvement in survival**

Ross: *Circulation*; 2016(134)e653-699





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Youth: Fitness and Metabolic Syndrome

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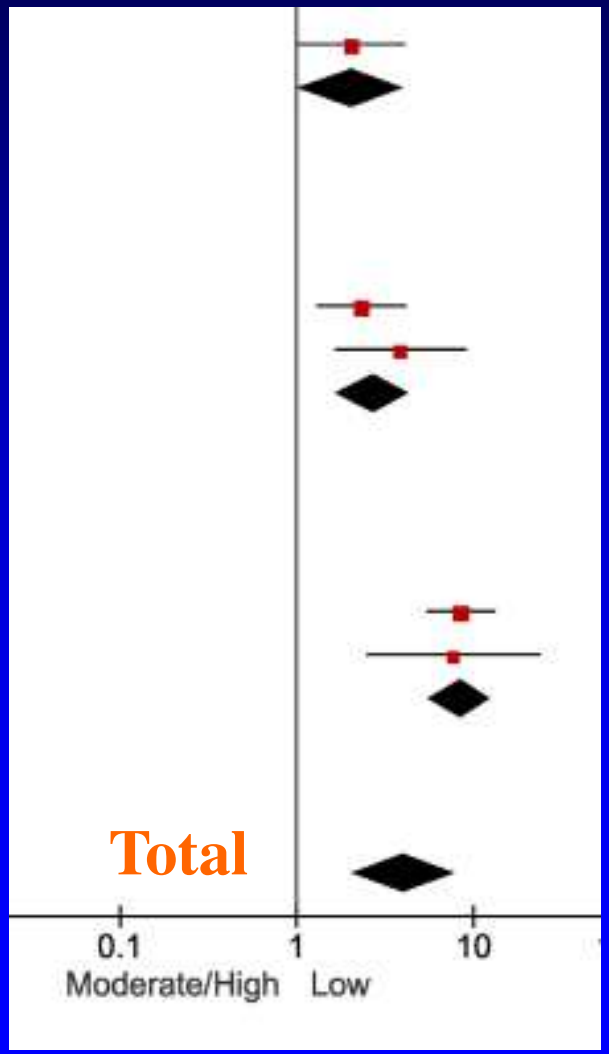
- Meta analysis
- 18 studies; 18,097 adolescents
- Compared odds of having metabolic syndrome with **low fitness** vs **moderate** and **high** fitness
- OR 4.05



De Oliveira: *PLoS One*; 2016, 11(12)e0168503

Moderate/high **Low**

Youth: Improved Lipid Profile

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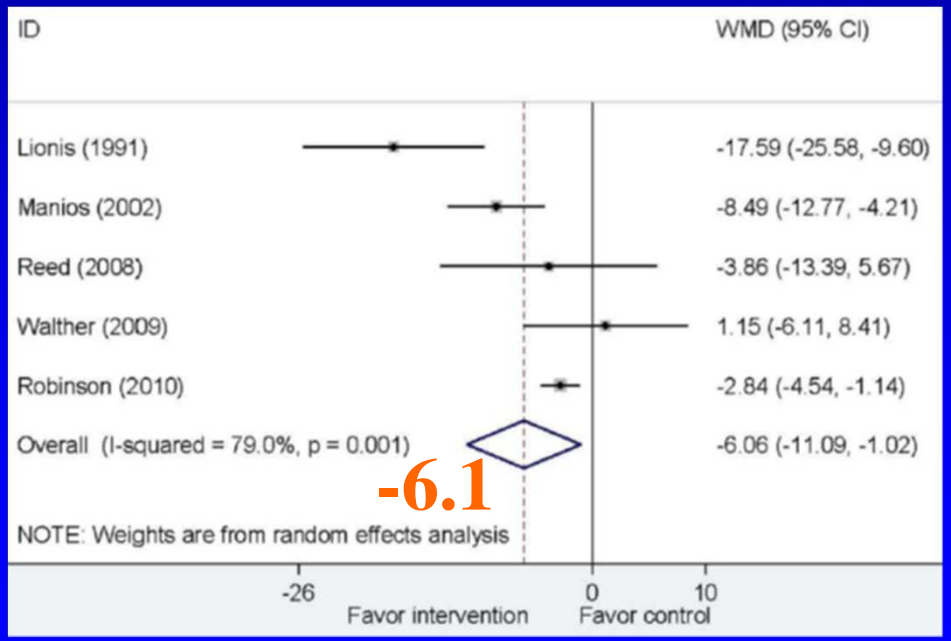
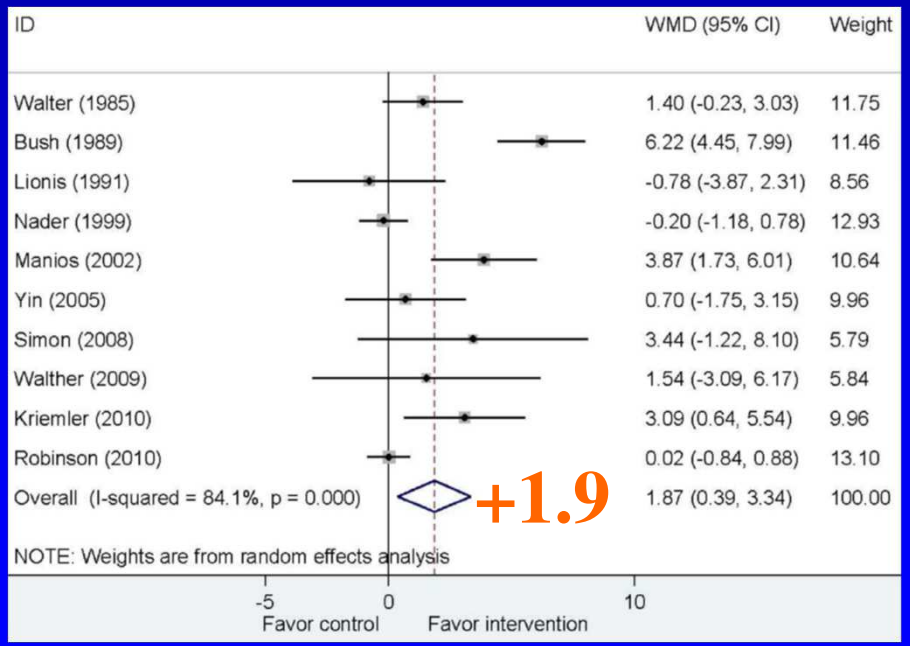
- **Meta analysis (2014), 17 studies; 13,136 participants**
  - **Diet and exercise program over 6-12 months**
  - **55% had no effect on either adiposity or lipids**

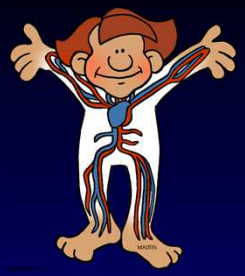
LDL



HDL



Cai: *Obes Rev*; 2014(15)933-944



Young: Improved Endothelial (Vascular) Function in Obese Patients

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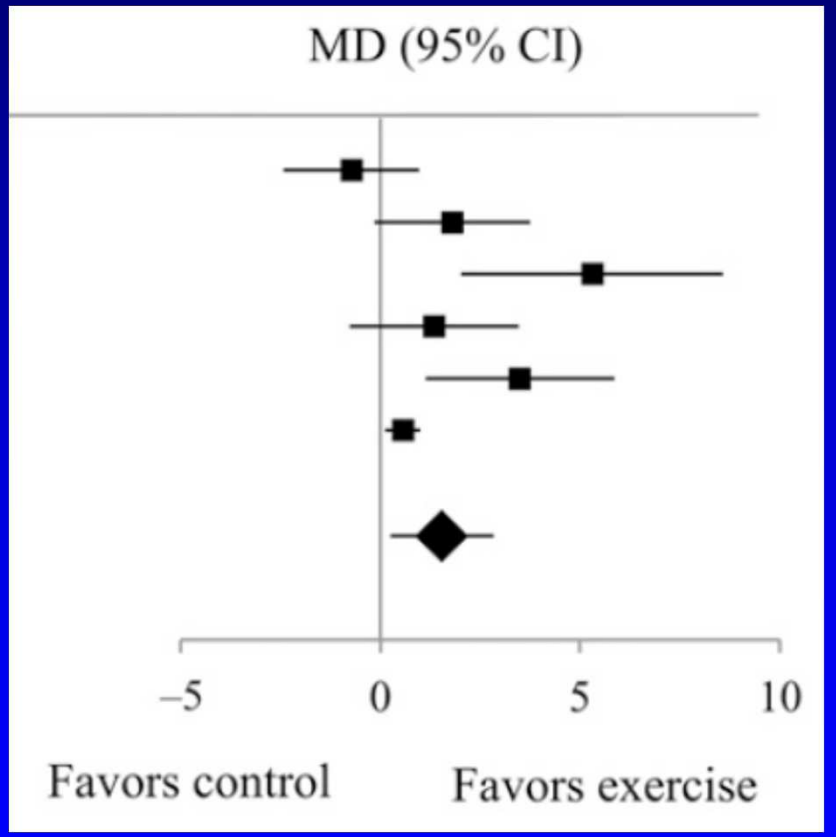
- **Endothelial function (dilation)**
  - Poor response
    - Precursor to atherosclerosis
  - Good response
    - Ass. with decreased CV mort.
- **Meta analysis; 219 children**
  - Exercise intervention
- **1.54% improvement**
  - (mean difference)
  - Similar adult study showing a 1% increase was associated with a 13% decreased in CV events

Flow Mediated Dilation



Control **Exercise**

Dias: *Pediatrics*; 2015(136)e648-659

Young: Improved Bone Health

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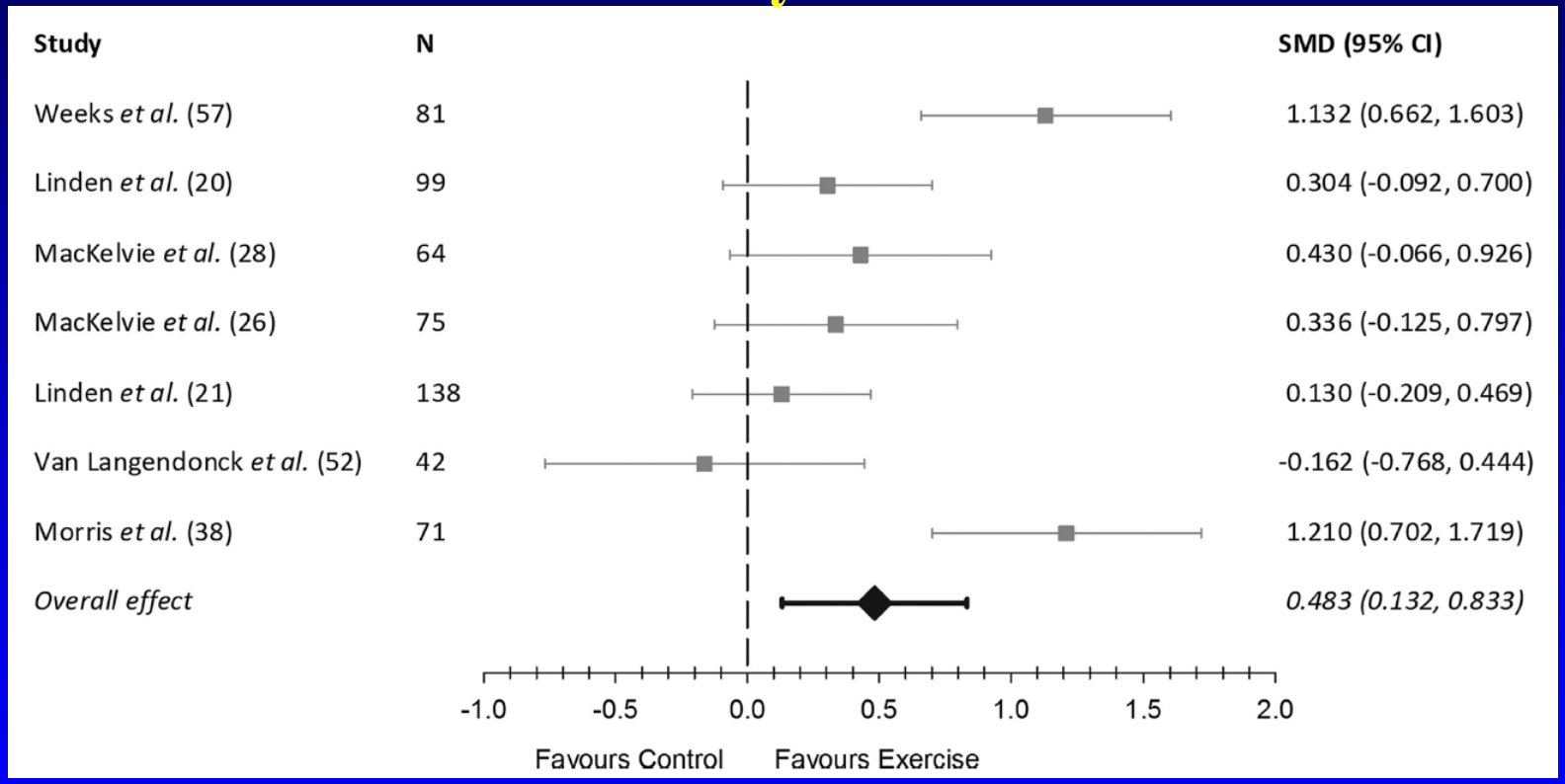
Whole Body Bone Mass



- ♥ Meta analysis; exercise interventions
- ♥ 16 trials, 570 children; small + effect (SMD = 0.48)

Nogueira: *Med and Sci in Sport and Exer*; 2014(46)610-621

Young: Long Term Bone Mineral Density Increase

- 581 females
- Positive association
  - Evaluated BMD at 12 years and again at 20-23 years
- Women who as adolescents spent >7hr/wk playing sports
- Mean bone mineral density 4% > than those who played 1 hr/wk

Fehily: *Am J Clin Nutr*; 1992(56)579-586

Youth: Increased Asthma with Low Physical Activity

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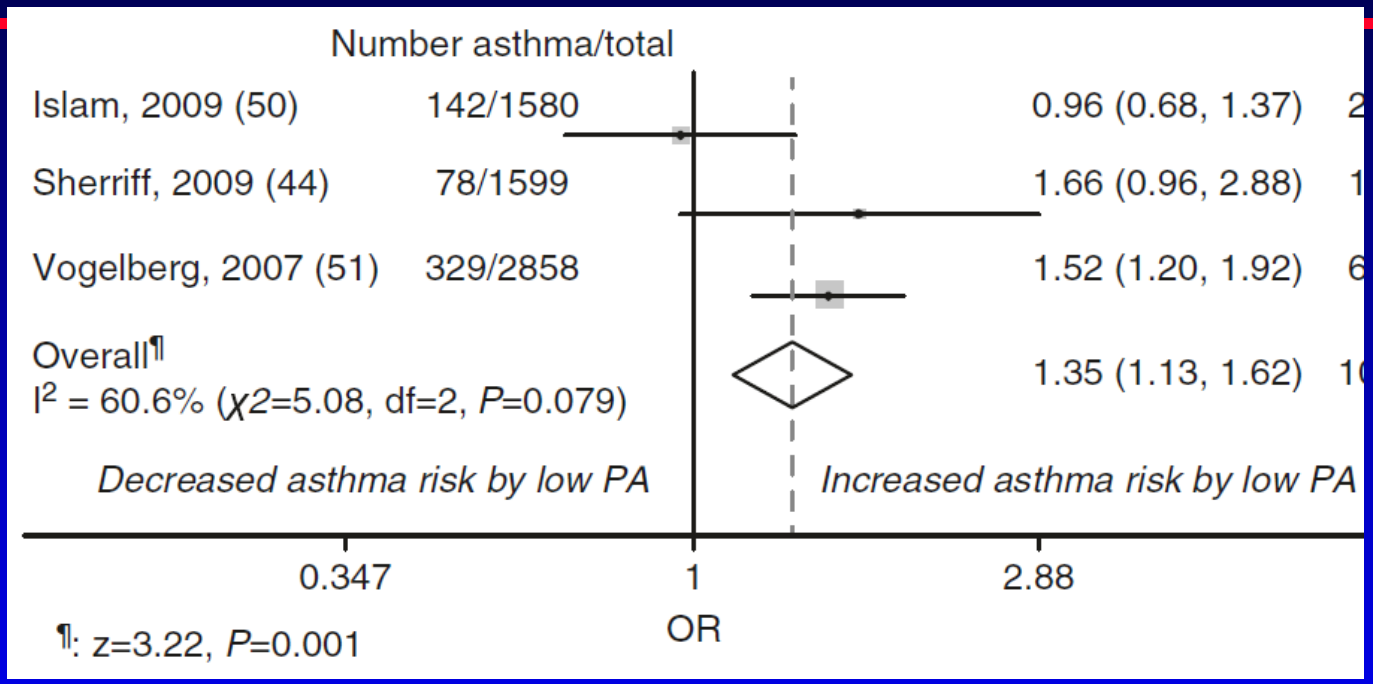

- **Meta analysis: 3 articles; 6,037 children**
  - **New onset asthma risk in low PA vs high PA**
  - **Odds ratio 1.35**

Lochte: *BMC Pediatrics;2016(16)50*

Youth: Decreased Myopia

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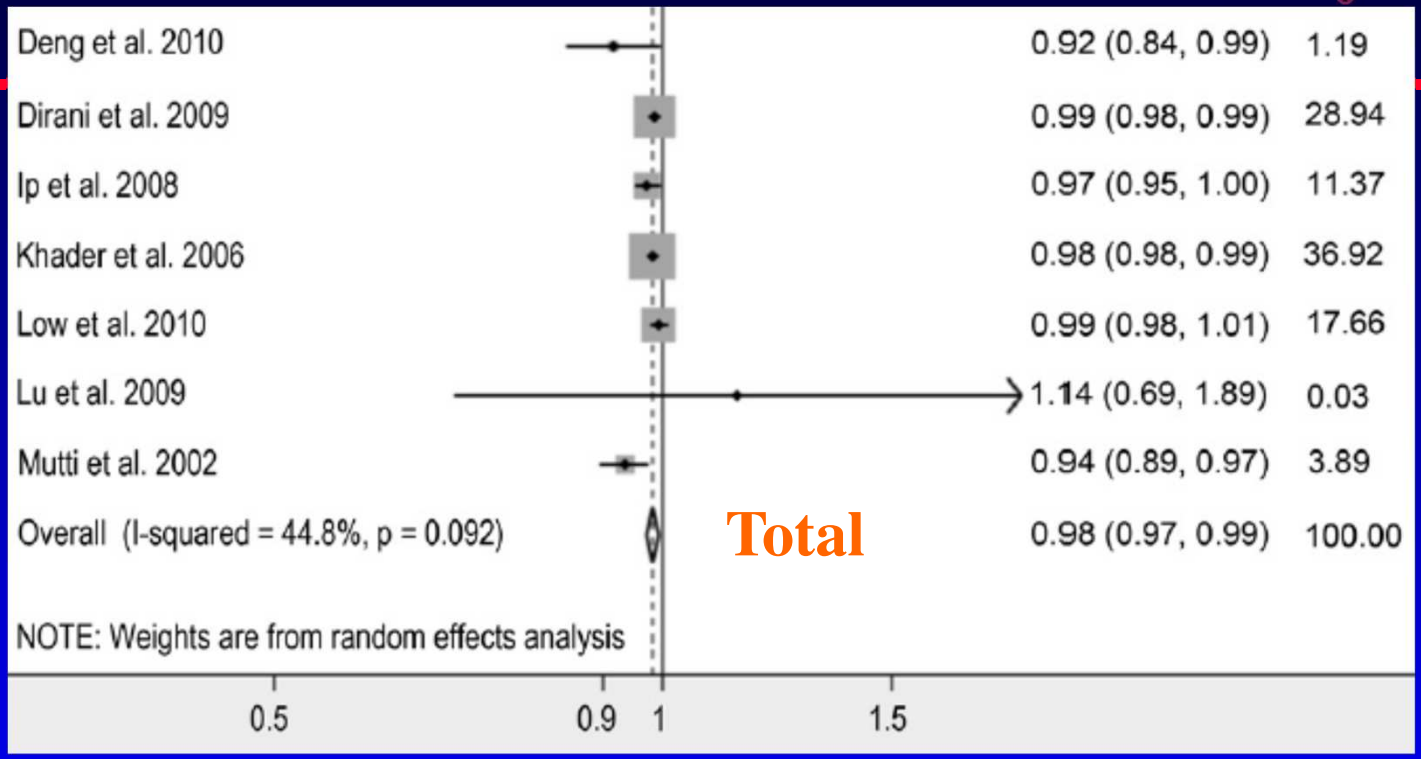
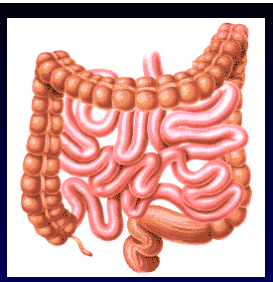


- **Meta analysis: 7 studies**
  - **Nearly 10,000 children and adolescents**
  - **2% reduced odds of myopia/hour/week of time spent outdoors**

Sherwin: *Ophthalmology*; 2012(119)2141-2151



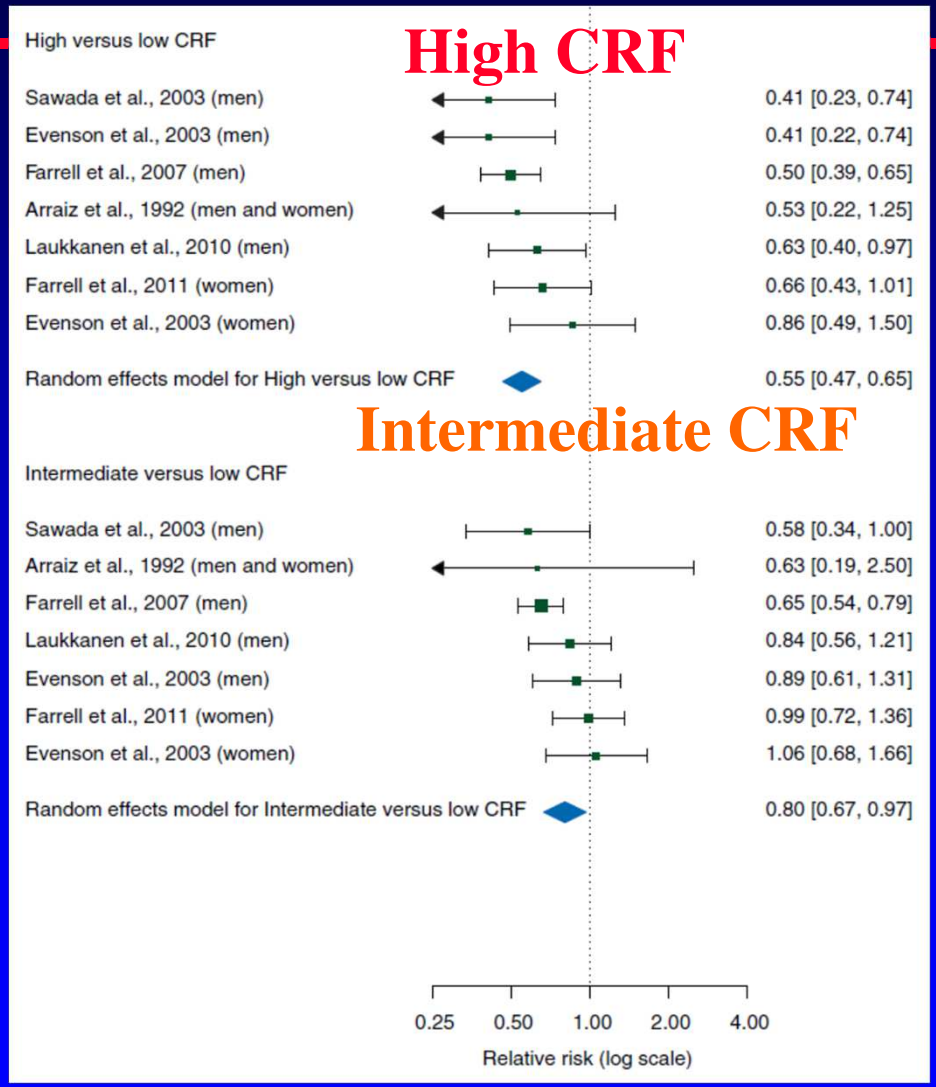
Adults: GI
Effects of Exercise

- Review article
- Enhances the number of beneficial microbial species
- May reduce:
  - Weight
  - Obesity associated pathologies
  - Other GI disorders
- Modulate mucosal immunity and improve barrier functions
- Produce substances that protect against colon cancer

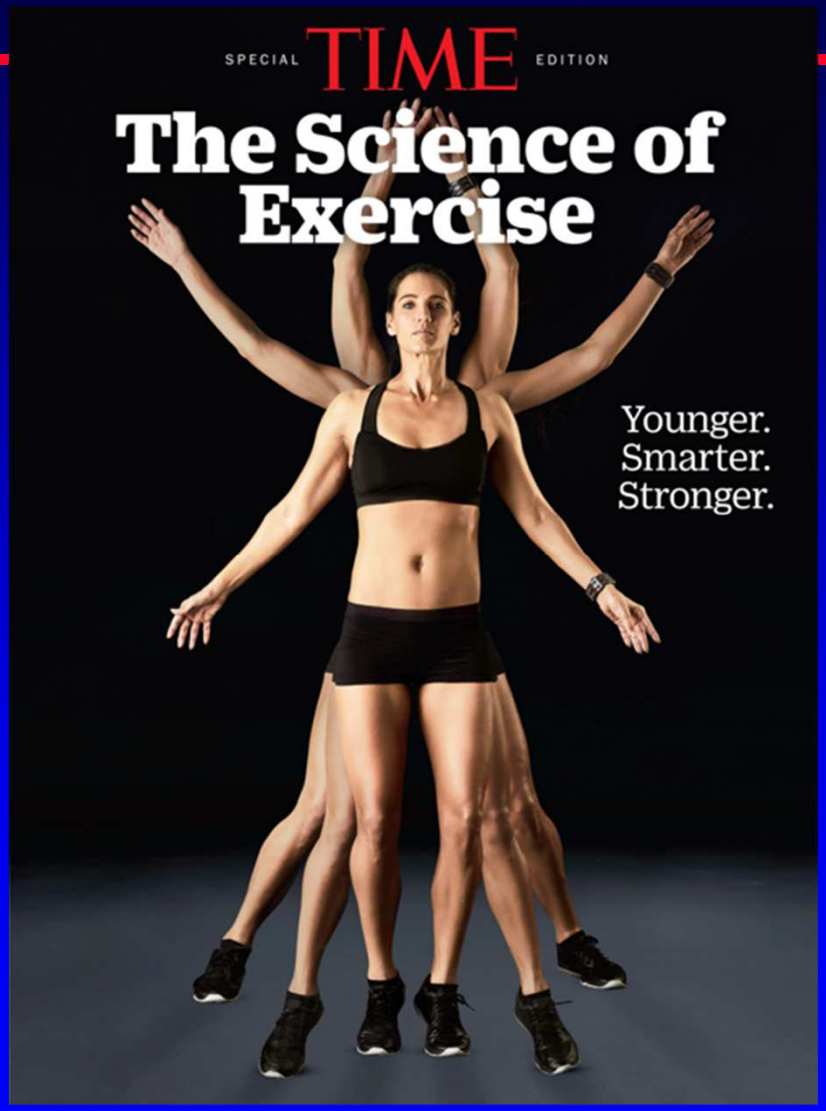
Monda: *Oxid Med Cell Longev*; 2017(2017)3831972

Adult: Reduced Risk of Cancer

- Meta-analysis
  - 6 studies; 71,654 individuals
  - FU 16.4 years
- Compared: High and intermediate CRF to low
- Total mortality reduction
  - High CRF: 45%
  - Intermediate CRF: 20%



Schmid: *Ann Oncology*: 2015(26)272-278



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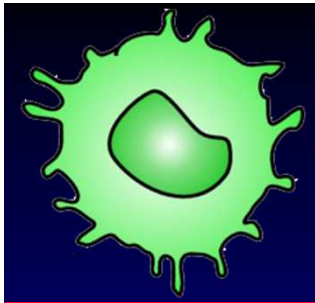

Adult Immunology: Exercise is Immuno-Enhancing

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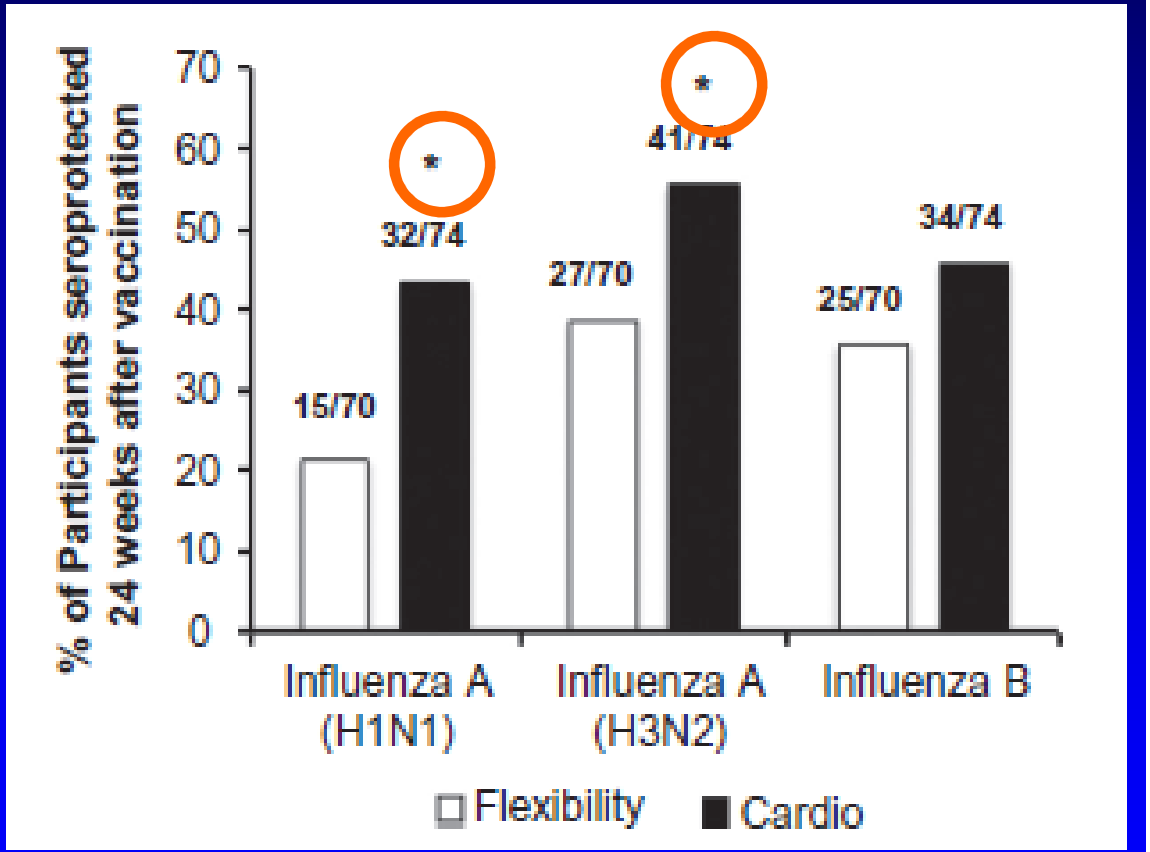
- Even a single bout
- Acute
  - Increased leukocytes
  - Increased chemotaxis (movement towards infection)
  - Increased phagocytosis
  - ? Increased N-killer cell function
- Regular moderate exercise improvements due to?
  - Acute effects
  - Reductions in inflammation
  - Maintenance of thymic mass
  - Altered ratios of "older" and "younger" immune cells

Simpson: *Progress in Molecular Biology and Translational Science*; 2015(135)355-380

Adult Immunology: Improved Vaccine Efficacy

PHOENIX CHILDREN'S Hospital

- Acute and chronic exercise of moderate intensity
  - (including single bout)
- Elderly, compared
  - Flexibility training vs aerobic training



Simpson: *Progress in Molecular Biology and Translational Science*; 2015(135)355-380

Adult Immunology: Reduced URI

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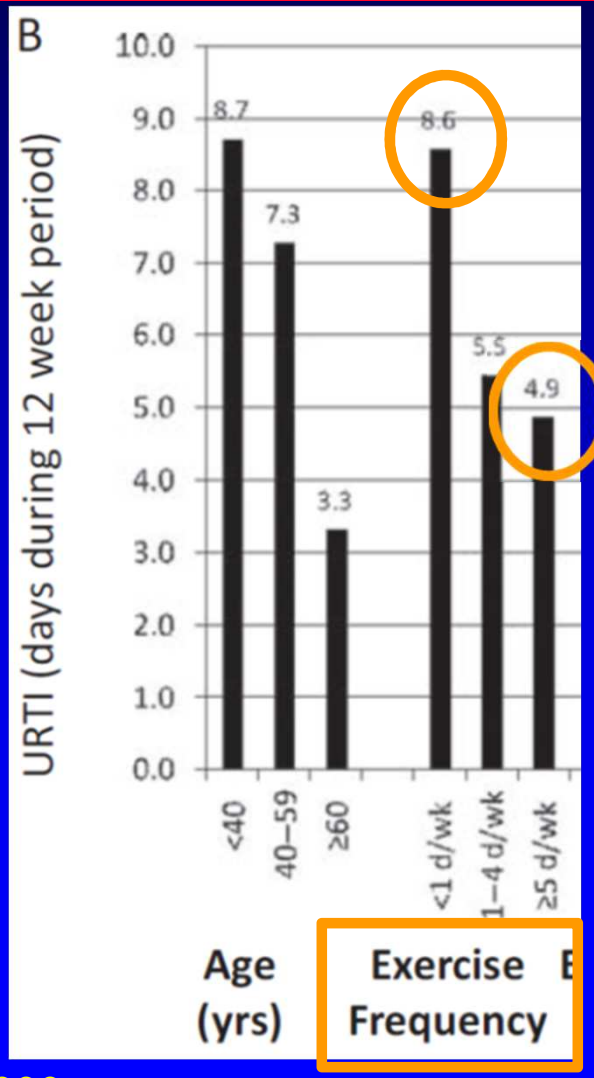
- 1002 Adults
  - 18-85 years
  - Follow 12 weeks during Winter
- Compared number of days with URI vs days/week of PA
  - Sedentary vs high PA
  - High PA subjects had 43% fewer days of illness



Nieman: *Br J Sports Med*; 2011(45)987-992

Youth: Exercise and Chronic Pain Therapy

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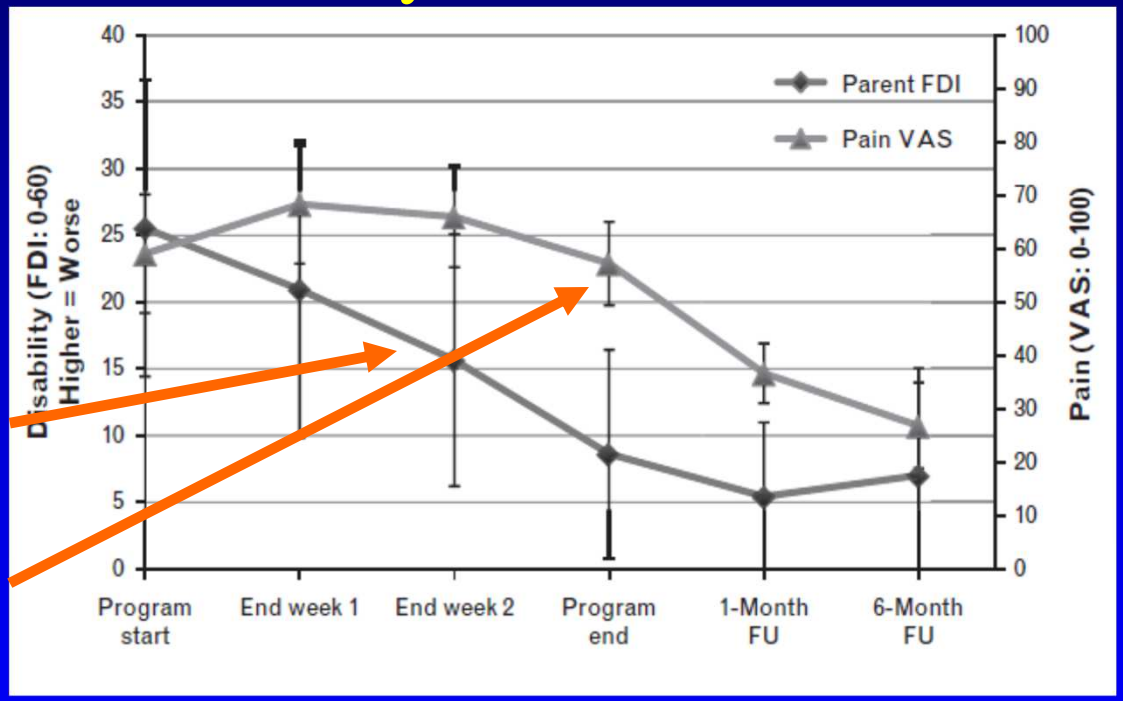
- 31 patients
- Intensive therapy
  - Exercise, cognitive, behavioral, yoga, music, art

Parent reported disability index

Patient reported pain scale

Disability and Pain Scores

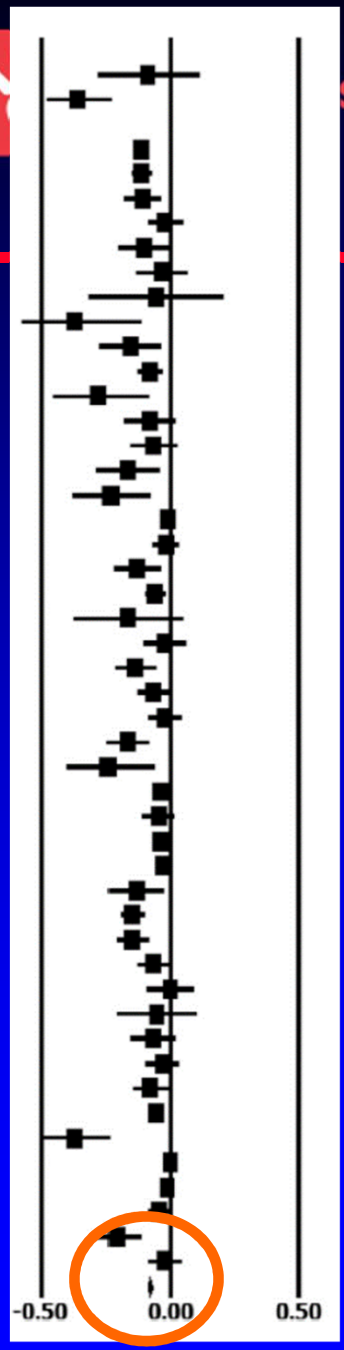


1 wk - 2 wk - End - 1 month - 6 month

Hoffart: *Rheumatology*; 2016(5)592-60

Youth: Depression

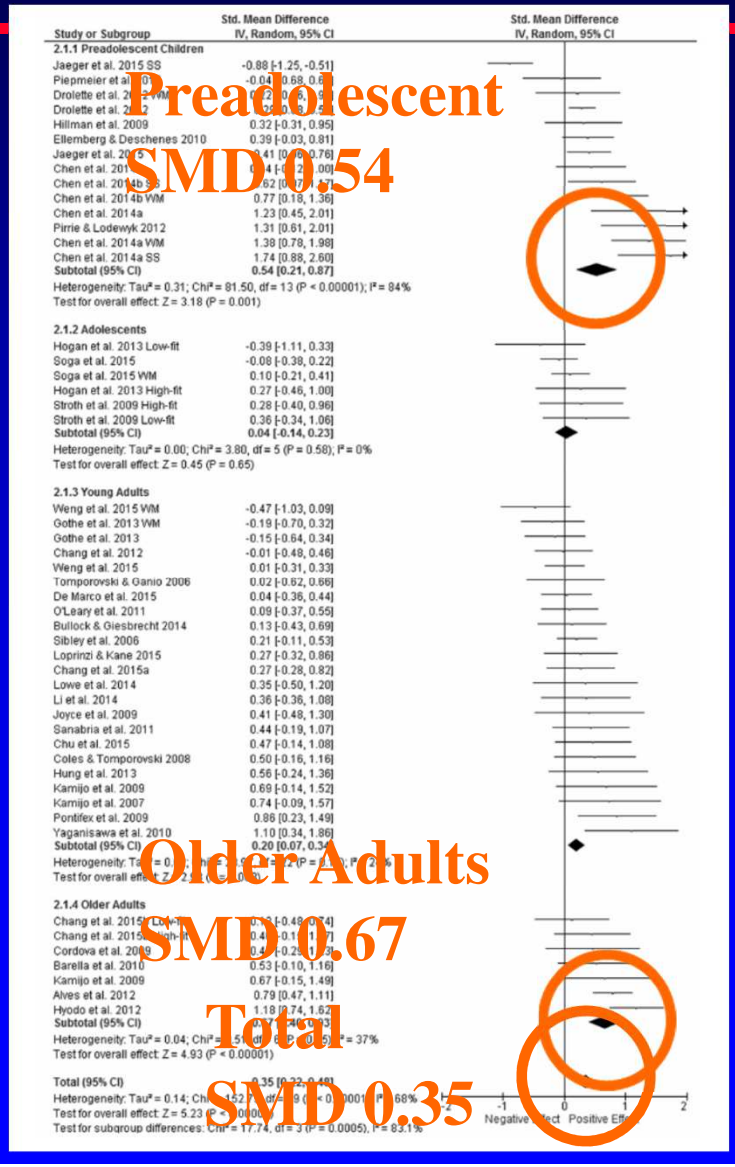
- Meta analysis
- 50 studies
  - 89,894 children and adolescents
  - Exercise intervention
  - Mean effect size -0.14 (portion of a SD)
- Higher PA associated with fewer symptoms



Korczak: *Pediatrics*; 2017;139(4):e20162266

Youth and Adults: Acute Effect of Exercise on Cognition

- Meta analysis, 40 studies
  - Acute effect of moderate exercise
- Conclusions:
  - Single bout moderate exercise improves executive function
  - Preadolescent and older adults might use a single aerobic session for a situation demanding high executive control
  - Not related to CRF



Ludyga: *Psychophysiology*; 2016(53)1611-1626

Youth: Improved Classroom Behavior and Academic Achievement

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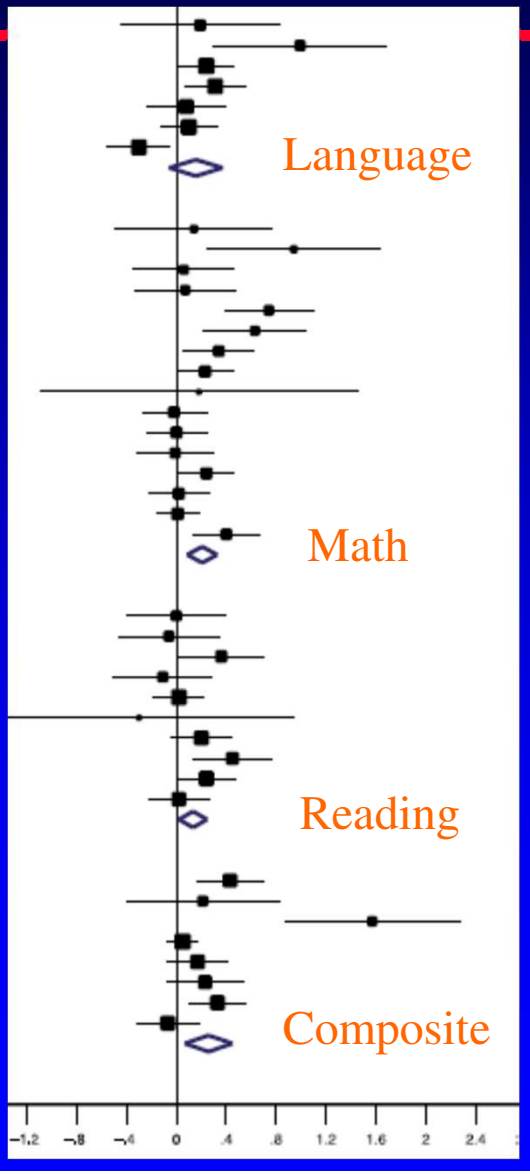
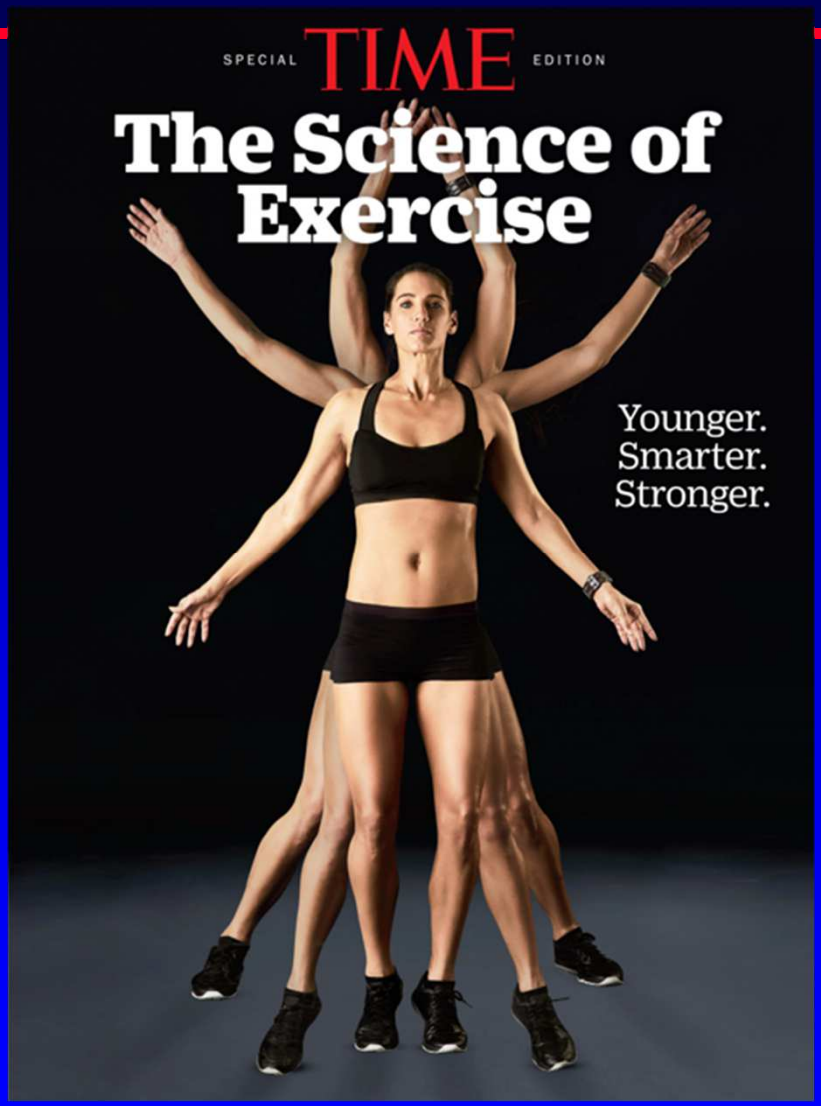
- Meta-analysis
- 26 studies; 10,2015 children
- PA/education interventions

	Effect Size (Portion of a Standard Deviation)
Language	**0.16**
Math	**0.21**
Reading	**0.13**
Composite	**0.26**
Time in on task behavior	**0.77**



Alvarez-Bueno: *Pediatrics*: 2017(140-6)e20171498



Recent research links exercise to less depression, better memory and quicker learning.

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Children: Exercise Improved Social Competence

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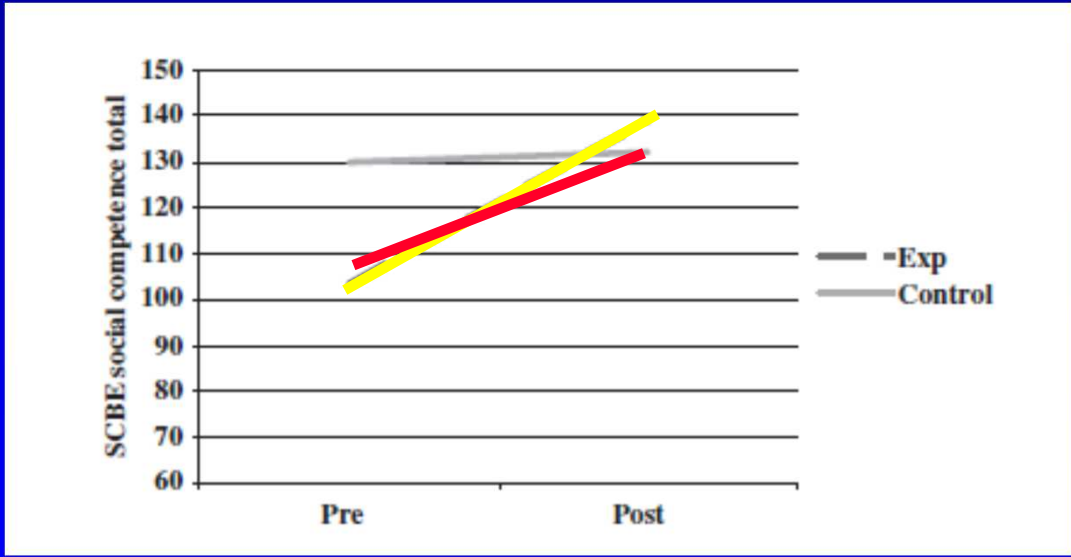
- 40 low income preschool children
  - 8 week course
  - Creative dance/movement
  - Compared to controls
- Significantly improved
  - Social competence



Parent Reported Social Competence

Teacher Reported Social Competence

Lobo: *Social Development*: 2006(15)501-519

Youth: Improved Physical Self Perception and Self Esteem

- **Systematic review**
  - 25 studies, youth
  - Exercise intervention
- **Improvements in**
  - Physical self perception
  - Enhanced self esteem

Lubans: *Pediatrics*; 2016(138)e20161642

Adult: Quality of Life

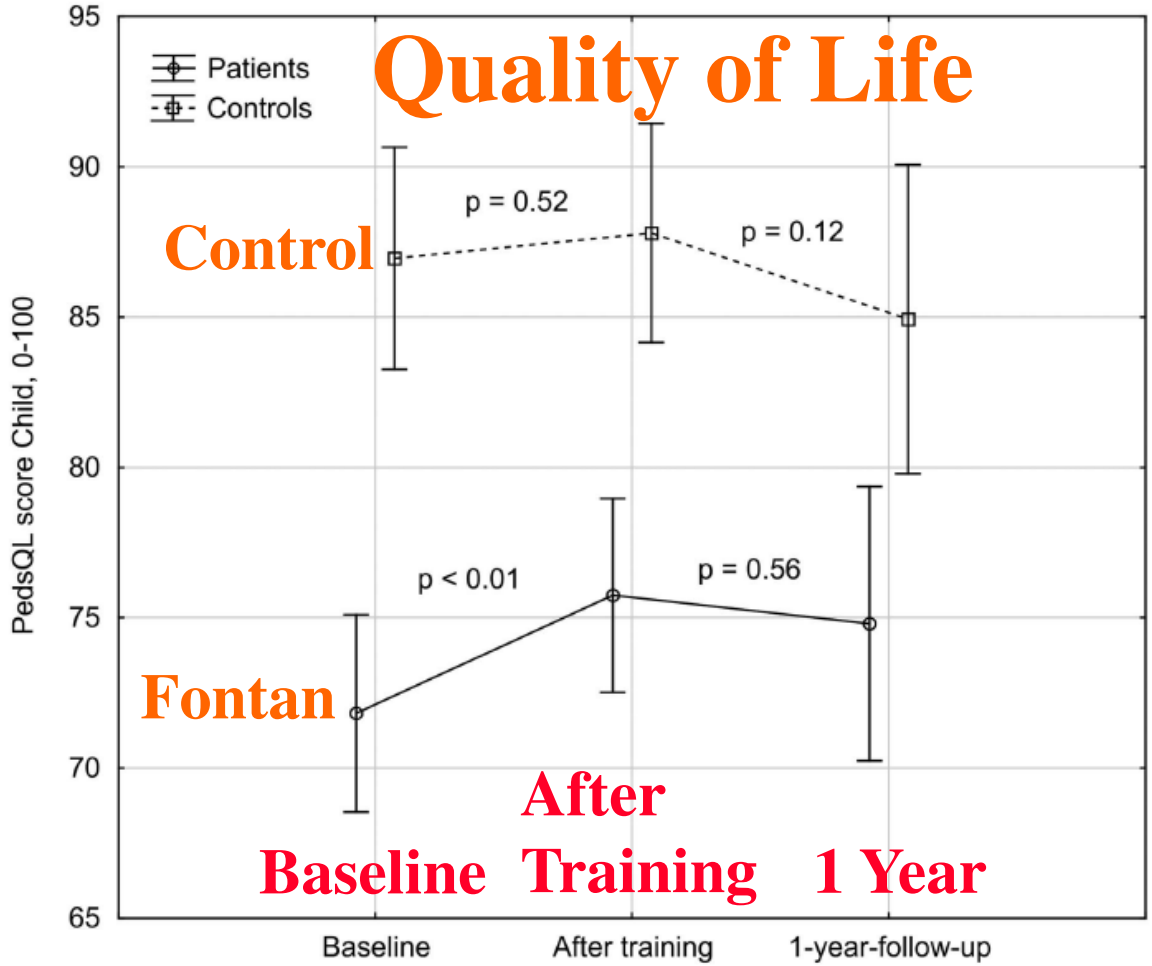
- Meta analysis
- 66 reports, 7,291
- Exercise intervention
- Assess QOL
  - QOL improved
    - Effect size 0.27

    (portion of a standard deviation)

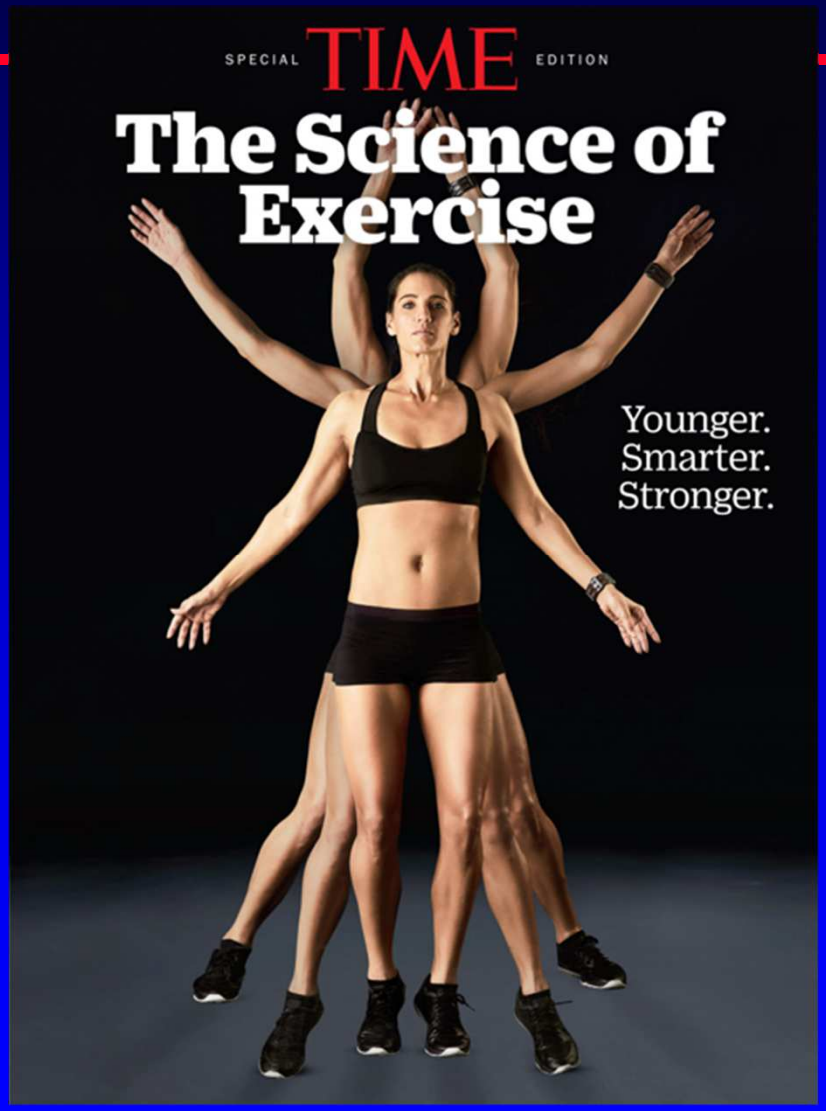
Conn: *Nurs Res*; 2009(58)175-183

Fontan: Quality of Life with Endurance Training

- 93 patients; 10-25 years
  - 12 week exercise program
- Quality of life improved
  - Sustained



Hedlund: *Cardiology in the Young*; 2017(14)1-9



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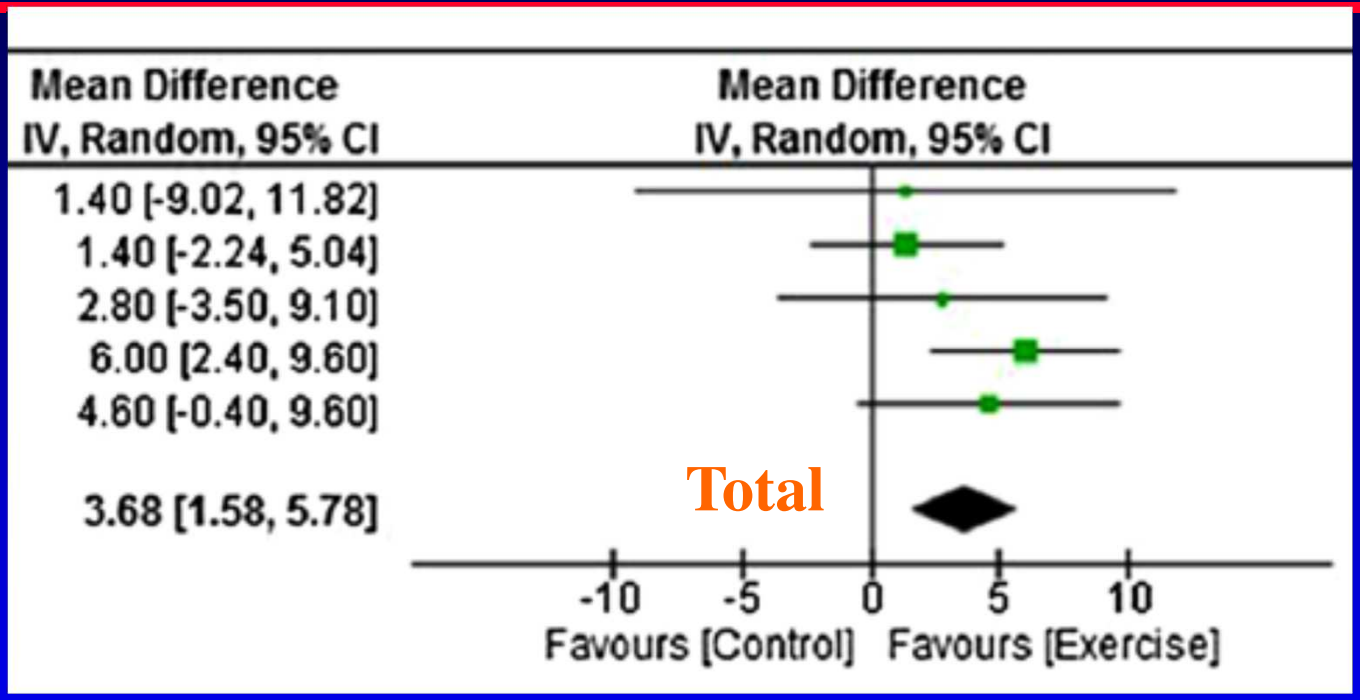
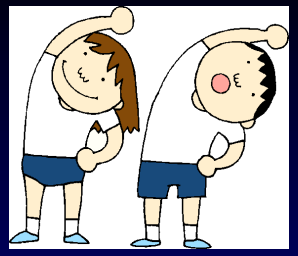
Youth: Exercise Training in CHD



- ♥ Meta Analysis (2016): 292 pts with CHD
  - Exercise training
- ♥ Improved peak VO2 of 3.7 ml/kg/min
  - 13% improvement

Gomes-Neto: *Pediatr Cardiol*; 2016(37)217-224



Adult: Who Can Benefit?

- High CRF is **not** necessary for significant health benefits
- For mortality largest benefits occur
  - Between the least fit and the next least fit group
  - > 50% of the reduction of all cause mortality
- Need not be athletic to get significant improvement
  - (Assumption: children not different)

Ross: *Circulation*; 2016(134)e653-699

Exercise Guidelines:

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♥ Adult

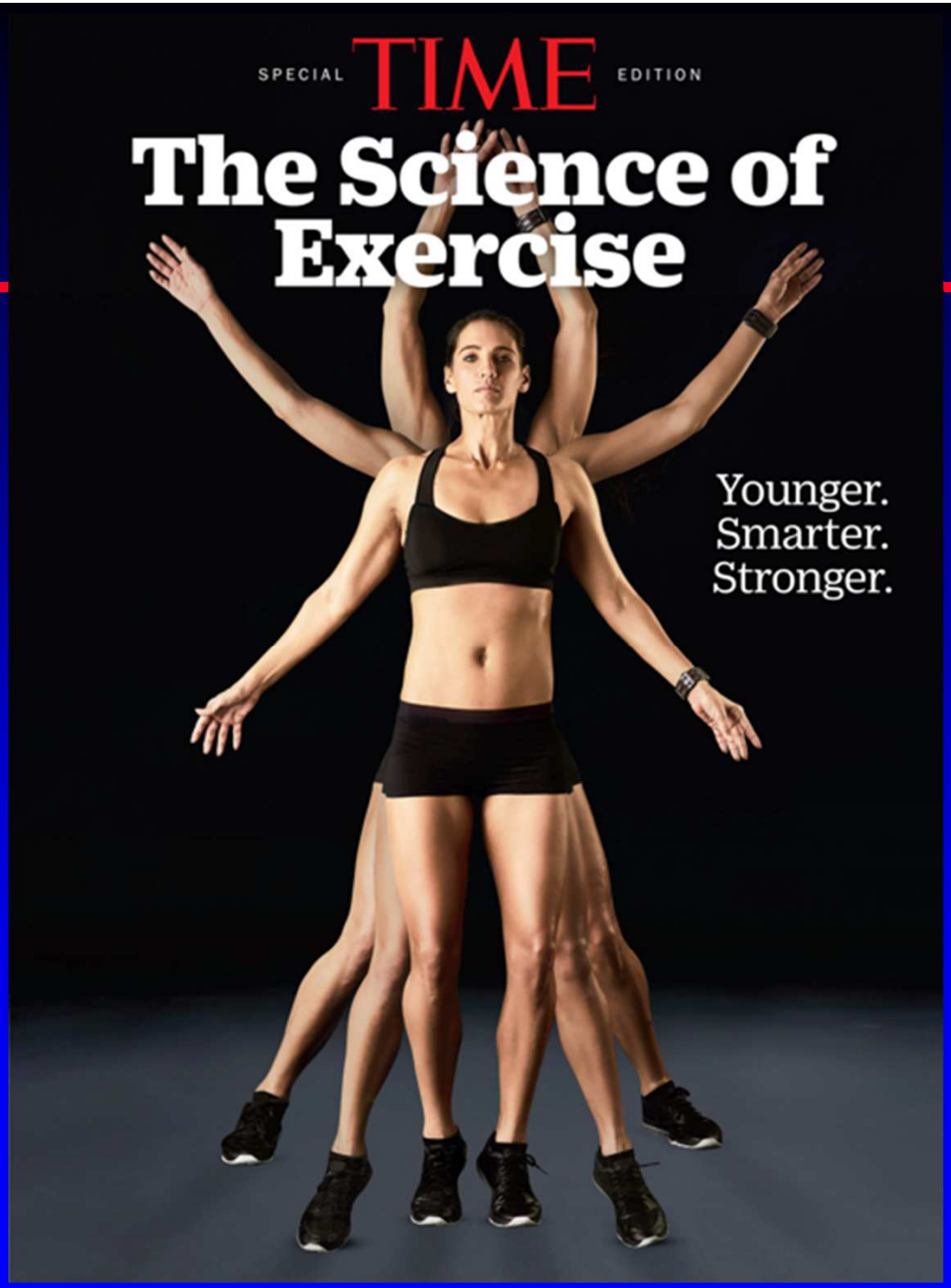
- 30-60 min/day of moderate to vigorous activity 5 or more days per week
  - 150 min/week moderate
  - 75 min/week vigorous

♥ Youth

- 60 min/day in moderate or higher activity
- 3 days/week vigorous activity that strengthens bone and muscle

US Department of Health and Human Services 2008 WHO 2010
Can Soc for Exer Phys 2012 Poitras: *Appl Physiol Nutr Metab*; 2016(41)S197-S239

Improved QOL
Improved Exercise Capacity
Decreased Anxiety
Decreased Stress
Improved Schizophrenia
Improved Parkinson's
Improved Multiple Sclerosis
Decreased Polycystic Ovarian Disease
Improved CHF
Improved Claudication
Improved COPD
Improved Microvascular Function
Reduced Asthma Risk
Improved Eyesight
Improved GI Microflora
Reduced Inflammation
Improved Immunity
Improved Vaccine Response
Reduced URIs
Improved Chronic Pain



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Decreased Depression
Improved Cognitive Skills
Improved Social Competence
Improved Self Perception
Improved Self Esteem
Decreased Mortality
Lengthened Lifespan
Decreased CV Morbidity
Moderated BP
Improved Lipid Profile
Weight Management
Improved Arthritis
Improved Bone Density
Improved Diabetes
Decreased Stroke
Reduced Cancer Risk
Decreased Dementia
Improved Cystic Fibrosis
Improved Osteoarthritis
Improved Osteoporosis
Improved Back Pain

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Improved QOL
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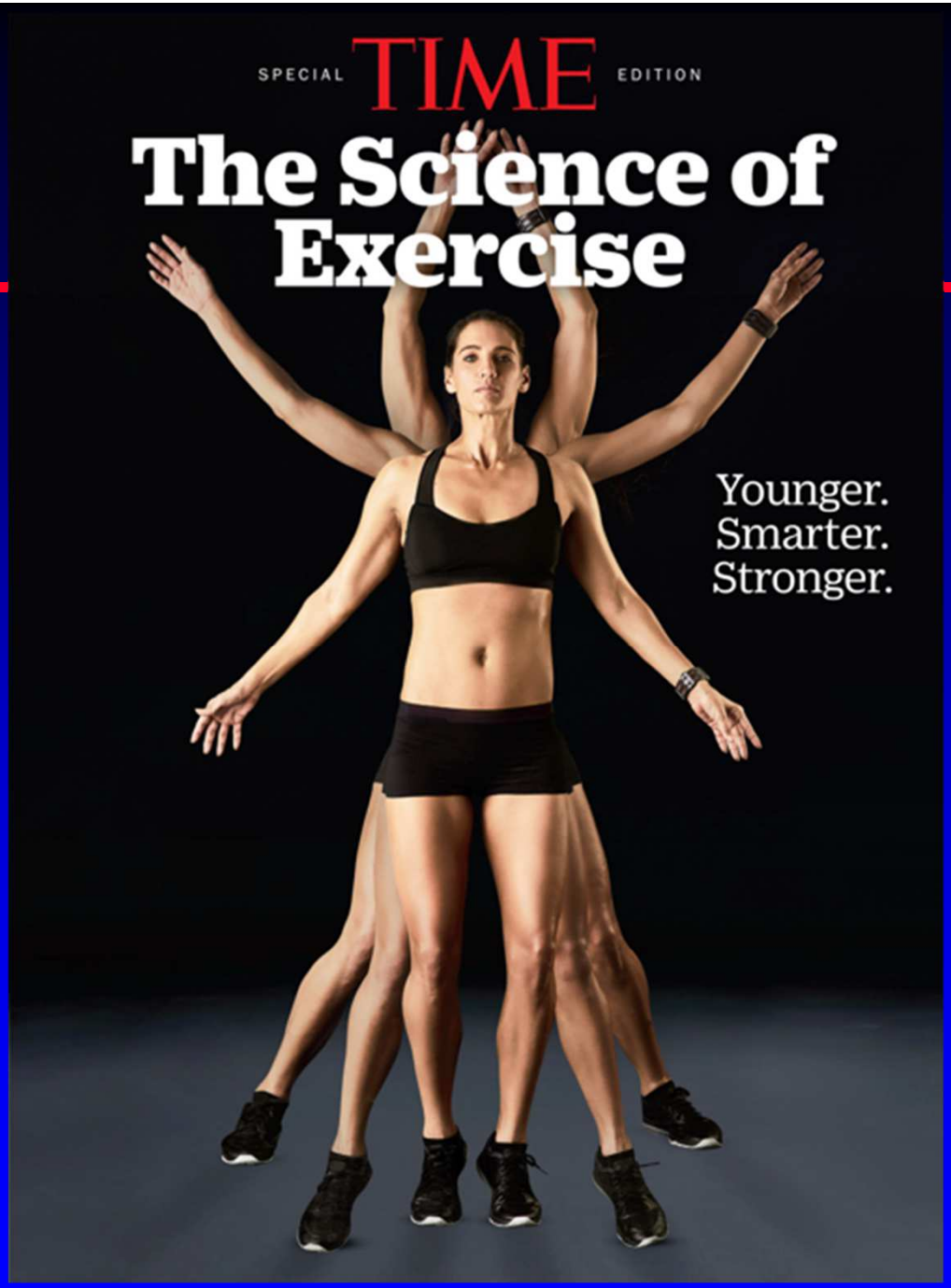
Improved Chronic Pain



PHOENIX CHILDREN'S Hospital

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