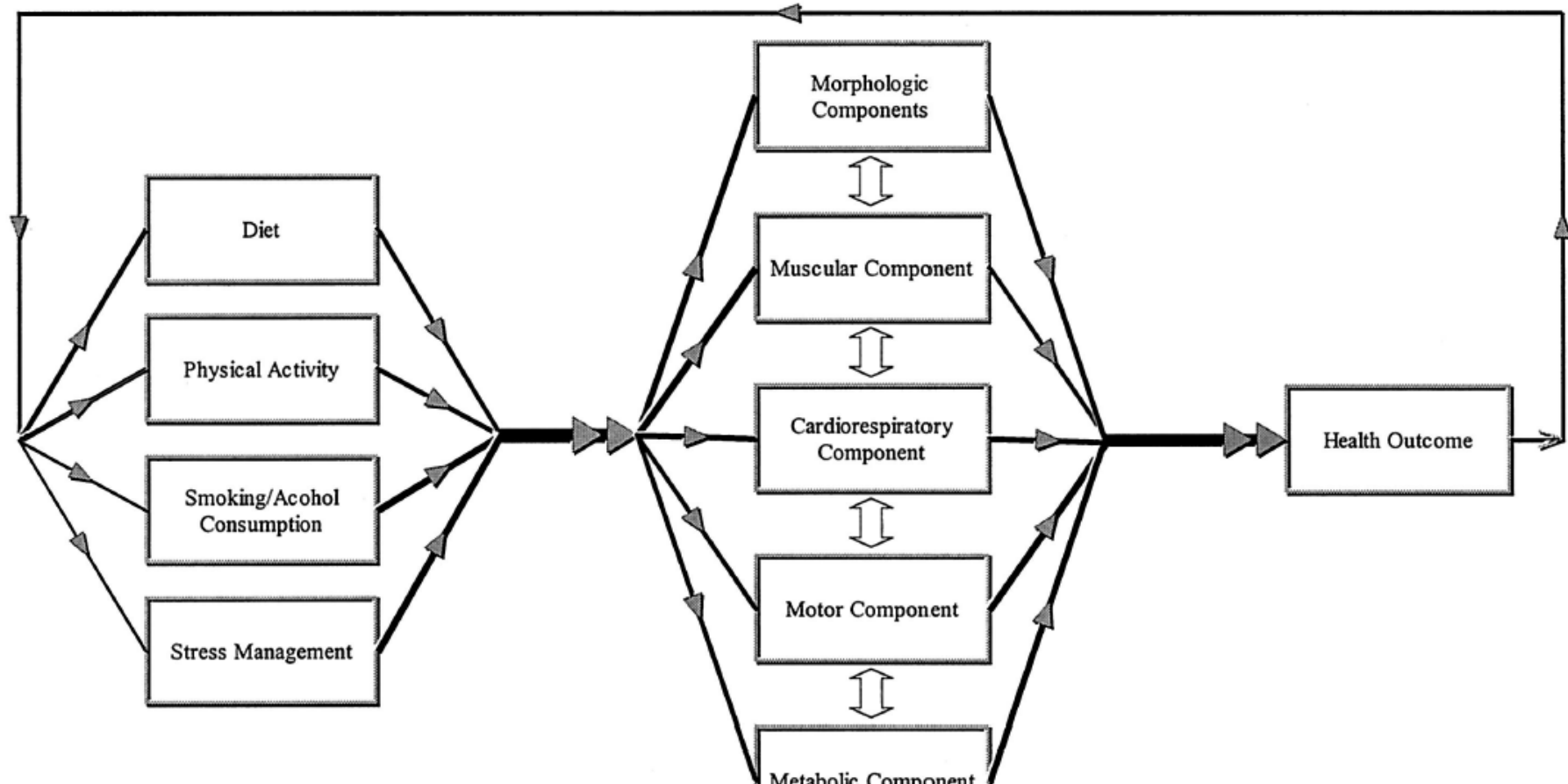


”Physical Activity, Fitness and Health”

OutTime.com en
Foto - FPS-aktiveringsprogram
krävs för att kunna se bilden.

Professor Björn Ekblom

Åstrand laboratory of Work Physiology
Gymnastik- och Idrottshögskolan, Stockholm



Physical activity → **Fitness** → **Health**

Behavior **Fitness** **Outcome**

Genetic/Social/Environmental Factors

Blair MSSE (2001)

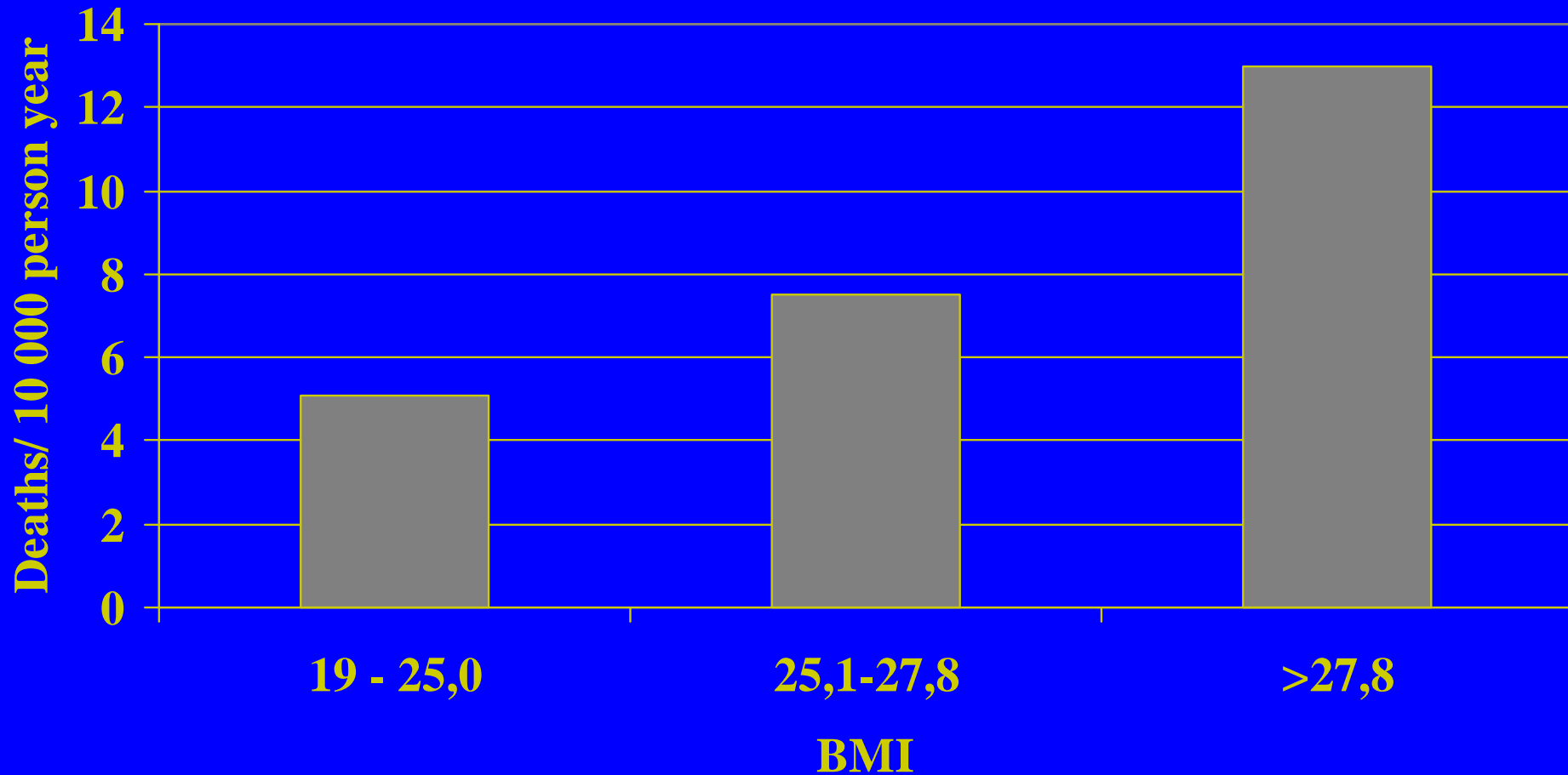
Typical longitudinal studies

- **Smoking**
- **Diet**
- **Heredity**
- **Plasma factors**
- **Body and fat mass**
- **Physical fitness**
- **Etc**

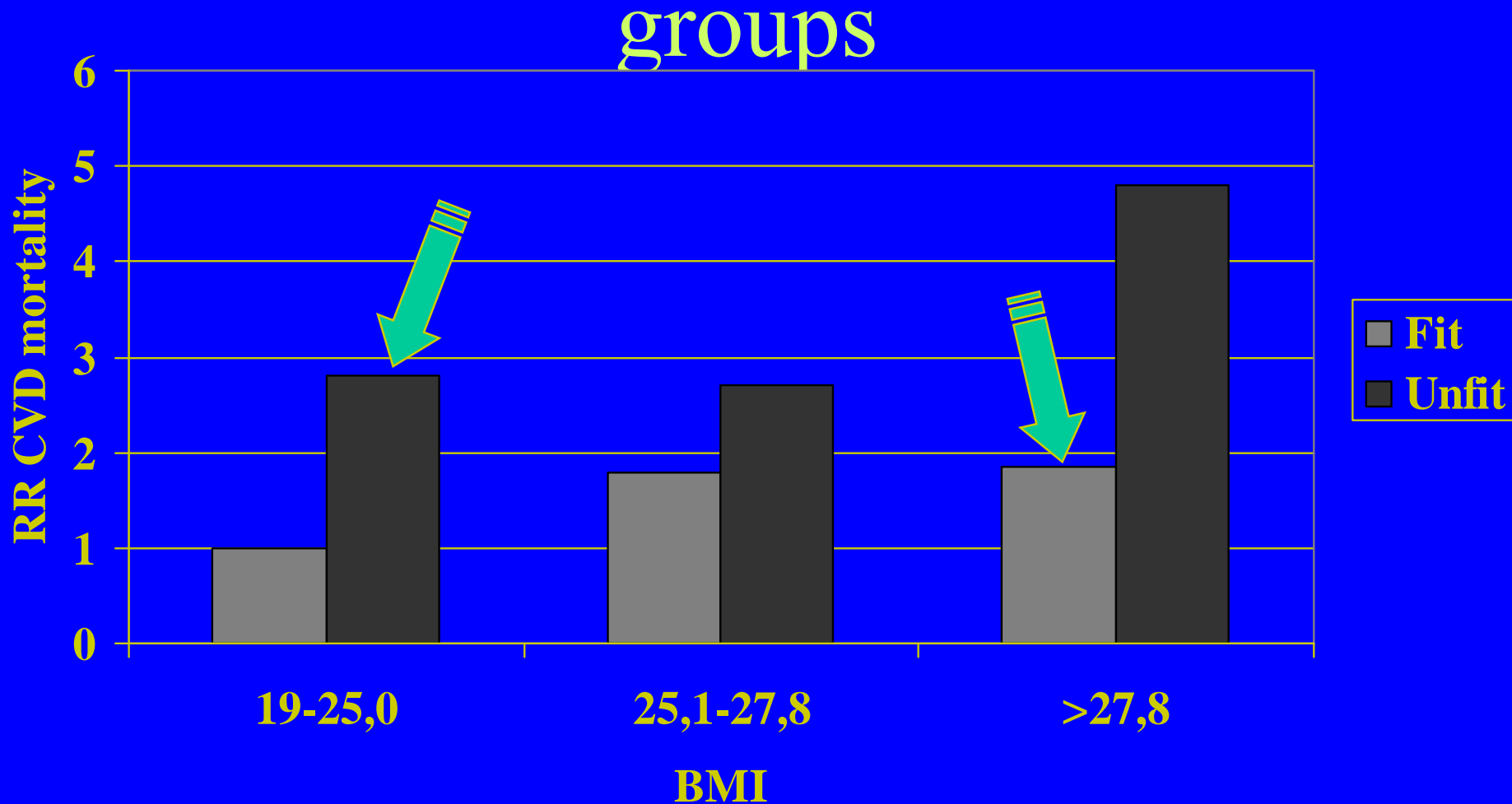
- Register:**
- **Deseased**
 - **Diagnosis**
 - **Days in hospital**
 - **Etc**



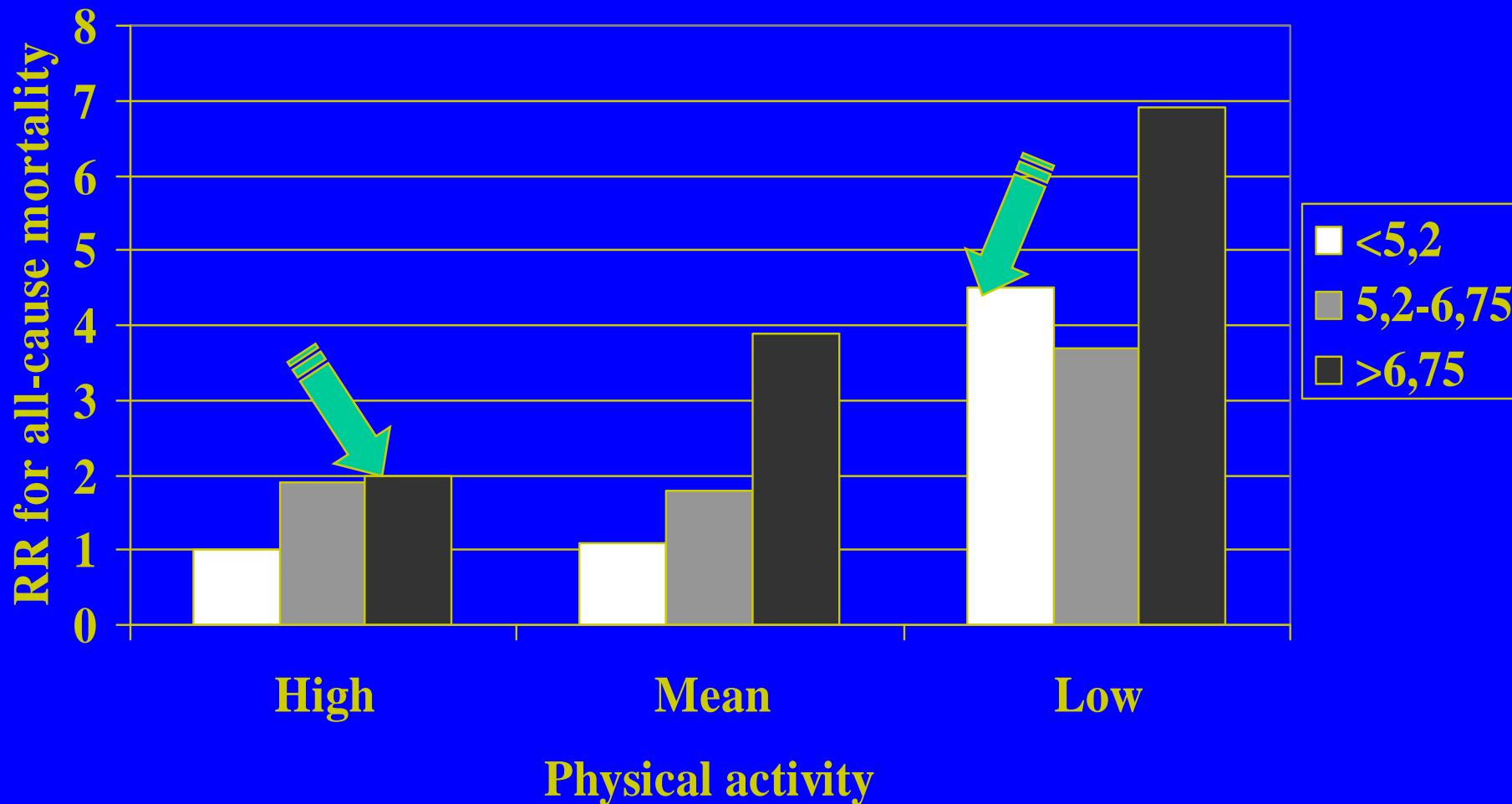
Overweight and mortality (CVD)



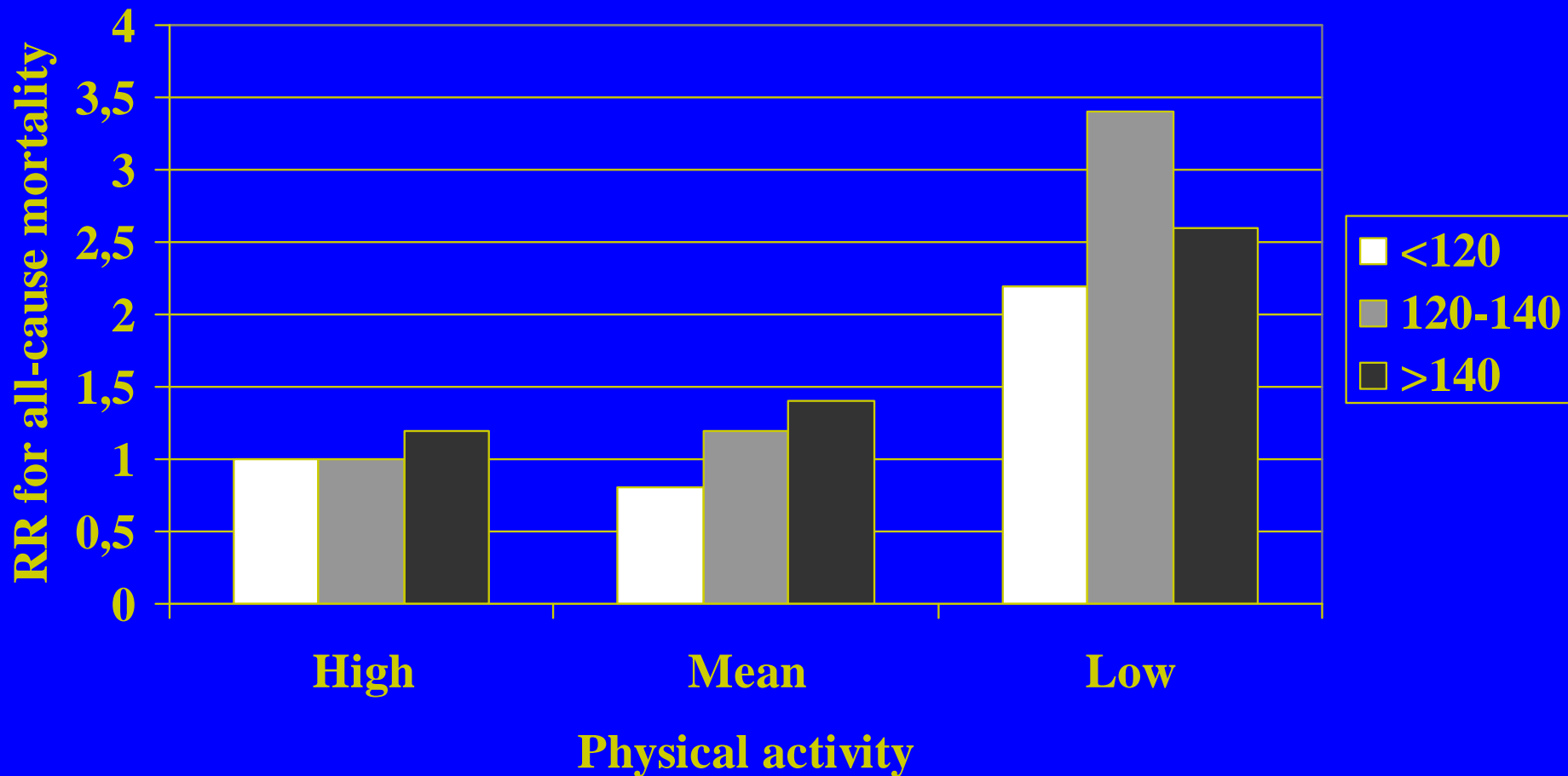
Relative risk for CVD mortality divided in BMI and fitness



Relative risk for all-cause mortality in relation to cholesterol levels and physical activity

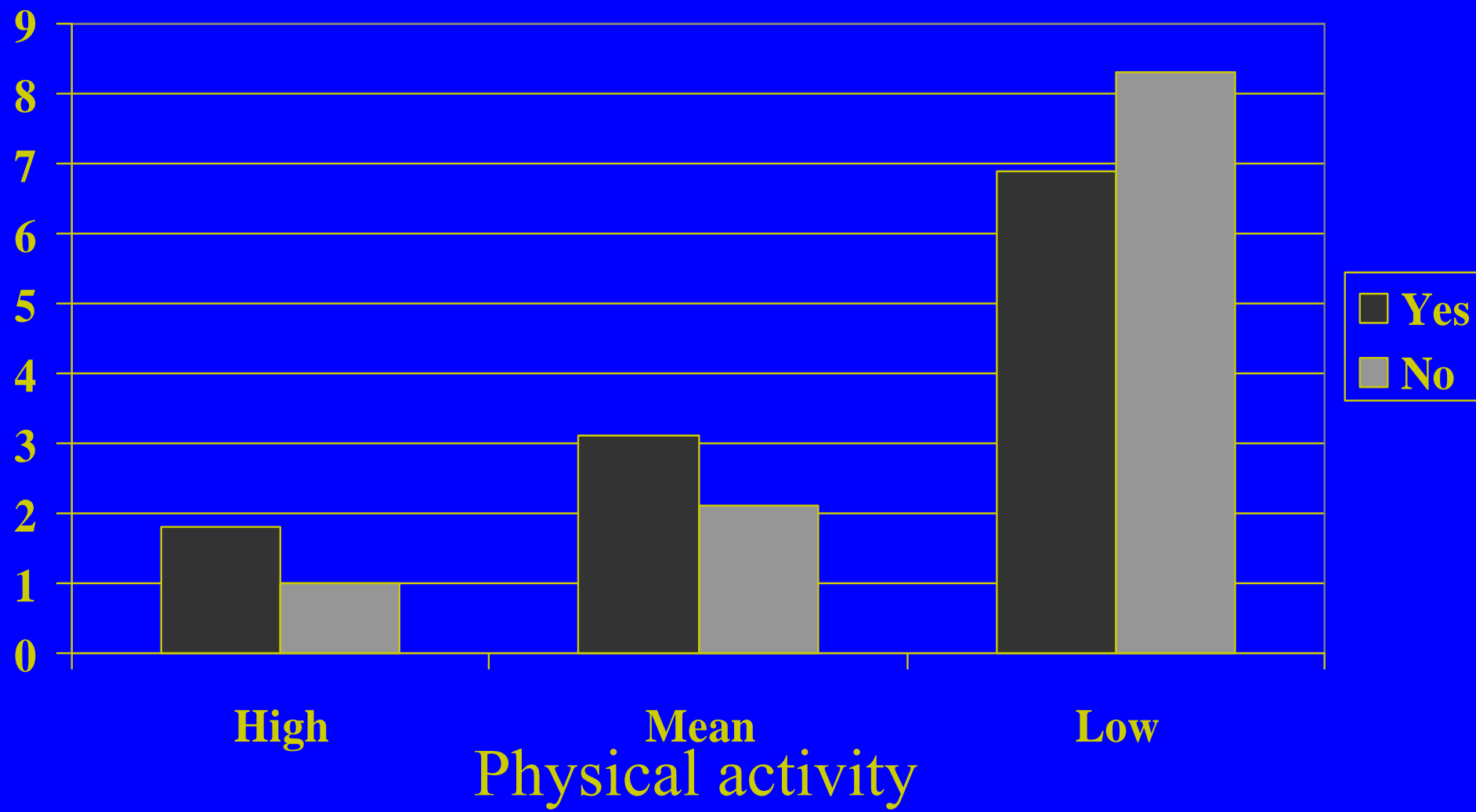


Relative risk for systolic blood pressure in relation to physical activity



Heredity and all-cause mortality

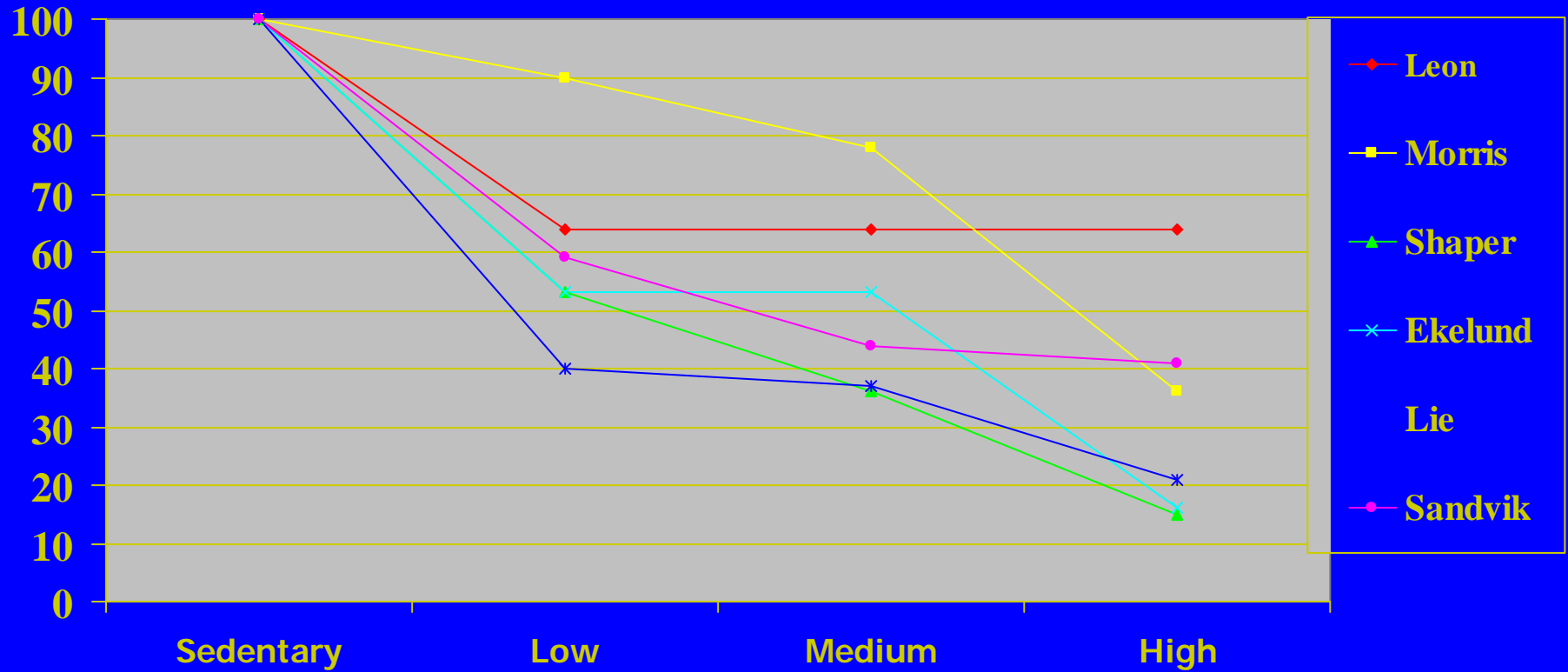
RR





DOSE-RESPONSE

Fitness and CVD mortality
(Blair & Connelly 1996)



Mortality among Wasa skii racers

Number of deaths

	Observed	Expected	SMR (95% CI)
All	339	692.4	0.49 (0.44–0.54)

Age (years)

16–30	31	50.1	0.62 (0.42–0.88)
31–40	30	66.1	0.45 (0.31–0.65)
41–50	82	142.6	0.57 (0.46–0.71)
51+	196	433.5	0.45 (0.39–0.52)

Mortality among Wasa skii racers

Number of deaths

	Observed	Expected	SMR (95% CI)
<u>Successful races (n)</u>			
1	181	353.5	0.51 (0.44–0.59)
2–3	102	195.9	0.52 (0.42–0.63)
4–5	34	74.1	0.46 (0.32–0.64)
6+	22	68.9	0.32 (0.20–0.48)

Finished time (Percentage of winner time)

100–120	2	2.8	0.72 (0.09–2.61)
121–160	42	79.0	0.53 (0.38–0.72)
161–200	111	235.5	0.47 (0.39–0.57)
201–240	112	226.6	0.49 (0.41–0.59)
>240	72	148.5	0.48 (0.38–0.61)

Diagnoses

Cause of death

	Observed	Expected	SMR 95% CI
Cancer			
All	119	191.3	0.62 0.52–0.74
Lung	8	36.2	<u>0.22 0.10–0.43</u>
All excluding lung	111	155.1	0.72 0.59–0.86
Cardiovascular diseases	109	245.4	0.44 0.36–0.54
Coronary heart disease	69	149.7	0.46 0.36–0.58
Cerebrovascular disease	12	39.5	<u>0.30 0.16–0.53</u>
Injury and poisoning	89	116.7	0.76 0.61–0.94
Transport accidents	16	21.6	0.74 0.42–1.20
Suicide	28	63.8	0.44 0.29–0.63
Other causes	22	139.0	<u>0.16 0.10–0.24</u>

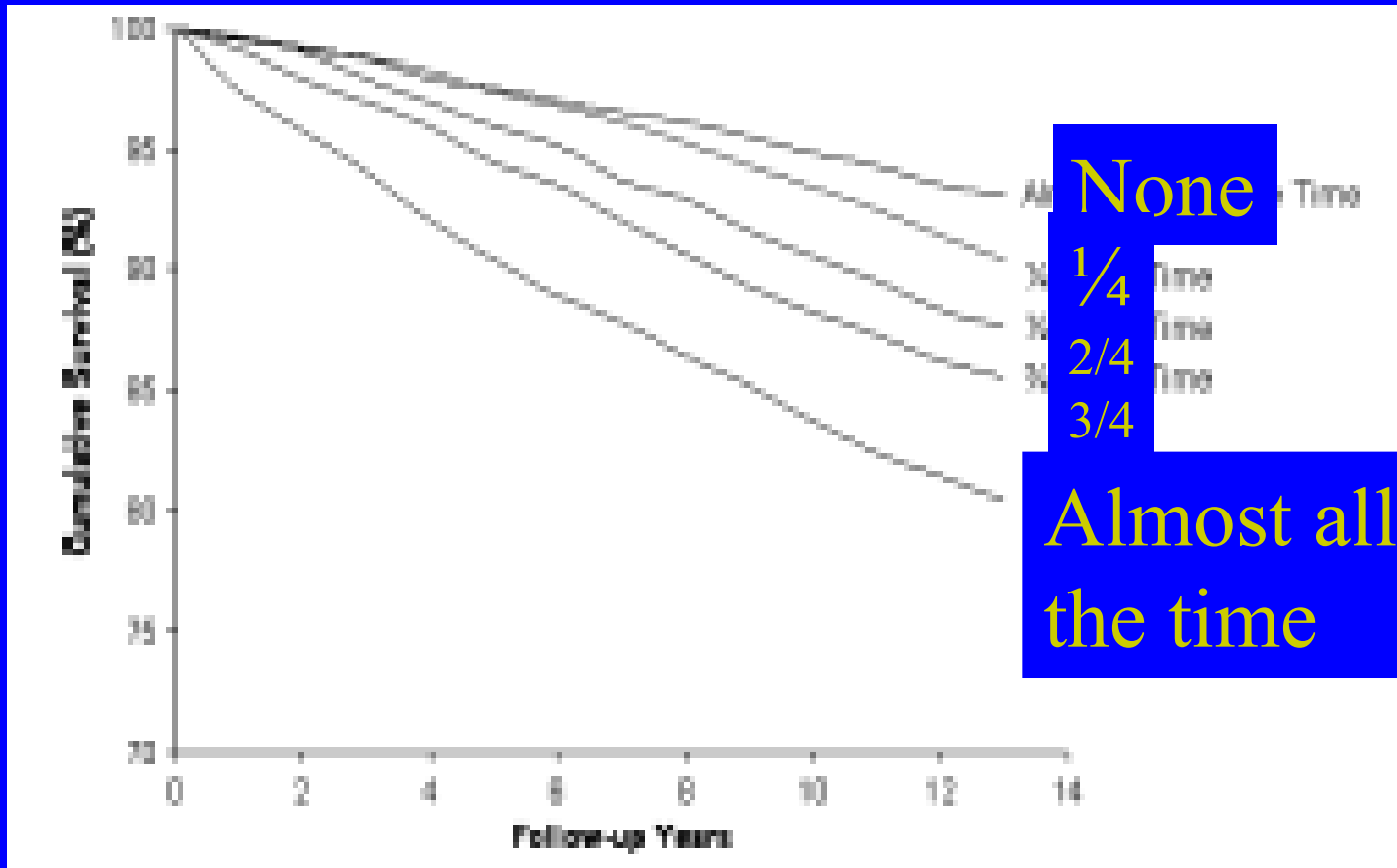
Hereditiy?

Parent characteristics

	General population(%)	Wasa racers (%)
Diseases		
Diabetes mellitus	13.7	16.0
Heart disease	24.4	23.1
Vascular disease	19.8	17.5
Cancer	21.2	27.4
Early death (before age 60)		
Heart disease	3.4	2.5
Vascular disease	2.0	2.7
Cancer	4.8	5.8

Sitting time

Cumulative survival



Follow up years

Method

LIV 90 and LIV 2000

Cross-sectional random sample studies of Swedish women and men, 20-65 years.

Fitness as VO_2max ($\text{ml min}^{-1} \text{kg}^{-1}$)

Fatness as waist circumference (cm)



Clustered CVD risk

≥ 3 risk factors compared with less

Fitness			Waist circumference		
	Odds ratio	95 % CI		Odds ratio	95 % CI
Tertile 1	1.00		Tertile 1	1.00	
Tertile 2	0.68	0.51-0.92	Tertile 2	1.98	1.38-2.84
Tertile 3	0.46	0.30-0.68	Tertile 3	3.75	2.59-5.43
Per ml	0.95	0.93-0.97	Per cm	1.05	1.03-1.06

Adjustment for age, gender, educational level, smoking, physical activity and fitness / waist circumference

Effect of regular physical training on the heart

1. Less need of oxygen

Reduction of HF, BP and stress hormones

2. Improved oxygen transport

Less atherosclerosis

HDL increases

LDL, VLDL decreases

Insulin sensitivity improves

Fibrinogen activity reduces

Increased angiogenesis

3. Heart function increases

Stroke volume and contractivity increase

4. Better resistance against arrhythmias

The vascular bed

The basis is: The shear stress

1. Endothelial function

- genes mediating oxidative metabolism, inflammation, nitric oxide synthase etc

2. Vascular smooth muscle function

- Ca^{+} mechanism, K^{+} channel function etc

3. Antioxidant systems

- SOD, Glutathione etc

4. Expression of heat shock proteins and other factors

5. Vascular remodelling

Muscle cell

Mitochondria

Increased enzyme activities

Increased antioxidant defence

Reduced ROS production

Metabolism

Enhanced insulin sensitivity

Enhanced protein synthesis and/or
reduced (?) degradation

Other effects, examples

- **COUNTERACT CHANGES WITH AGING**
 - ↑ Heart rate variability & working capacity
 - ↑ Myocardial antioxidant capacity
 - ↓ Inflammation markers - e.g. C-reactive protein
 - ↓ Apoptotic markers - e.g. calpain, caspase-3
 - Remodeling of the left ventricle

Other effects, examples

COUNTERACT CHANGES WITH MENOPAUS

↑ Baroreflex sensitivity

↑ Endothelial-dependent flow-mediated
vasodilatation

↑ Central arterial compliance

↓ Oxidative stress

Further reading

Leung, Yung, Laher et al 2009.

Seven different types of physical activity

- Small "automatic" movements
 - Normal daily activity
 - Transport from home to job/school
 - At the job
 - Hobby
 - Regular physical exercise
 - Competition – training and performance
- } Neat

Levine's "Plus Calorie Study" 1999

- 16 subjects 1000 kcal extra/day, 8 w.
- Physical activity and other measures
- Average + 4,7 kg
- Range 1,4 – 7,2 kg
- No difference in BMR and thermogenesis
- Difference in NEAT – the two first types of physical activity

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