CHHP
CENTRE FOR HEALTH & HUMAN PERFORMANCE

Physical Activity: Weight Management & Diabetes

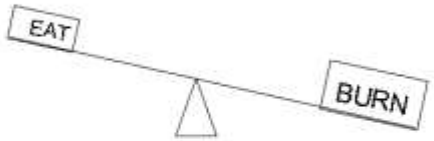
Professor Gregory P Whyte OBE PhD DSc FBASES FACSM

Research Institute for Sport & Exercise Sciences
FACULTY OF SCIENCE

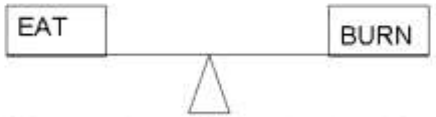
liverpool JMU

Energy Balance

a. Weight Gain: 'Positive energy balance' – when the number of calories eaten is greater than the number of calories burnt



b. Weight Loss: 'Negative energy balance' – when the number of calories eaten is less than the number of calories burnt



c. Weight Maintenance: 'energy balance' – when the number of calories eaten is equal to the number of calories burnt

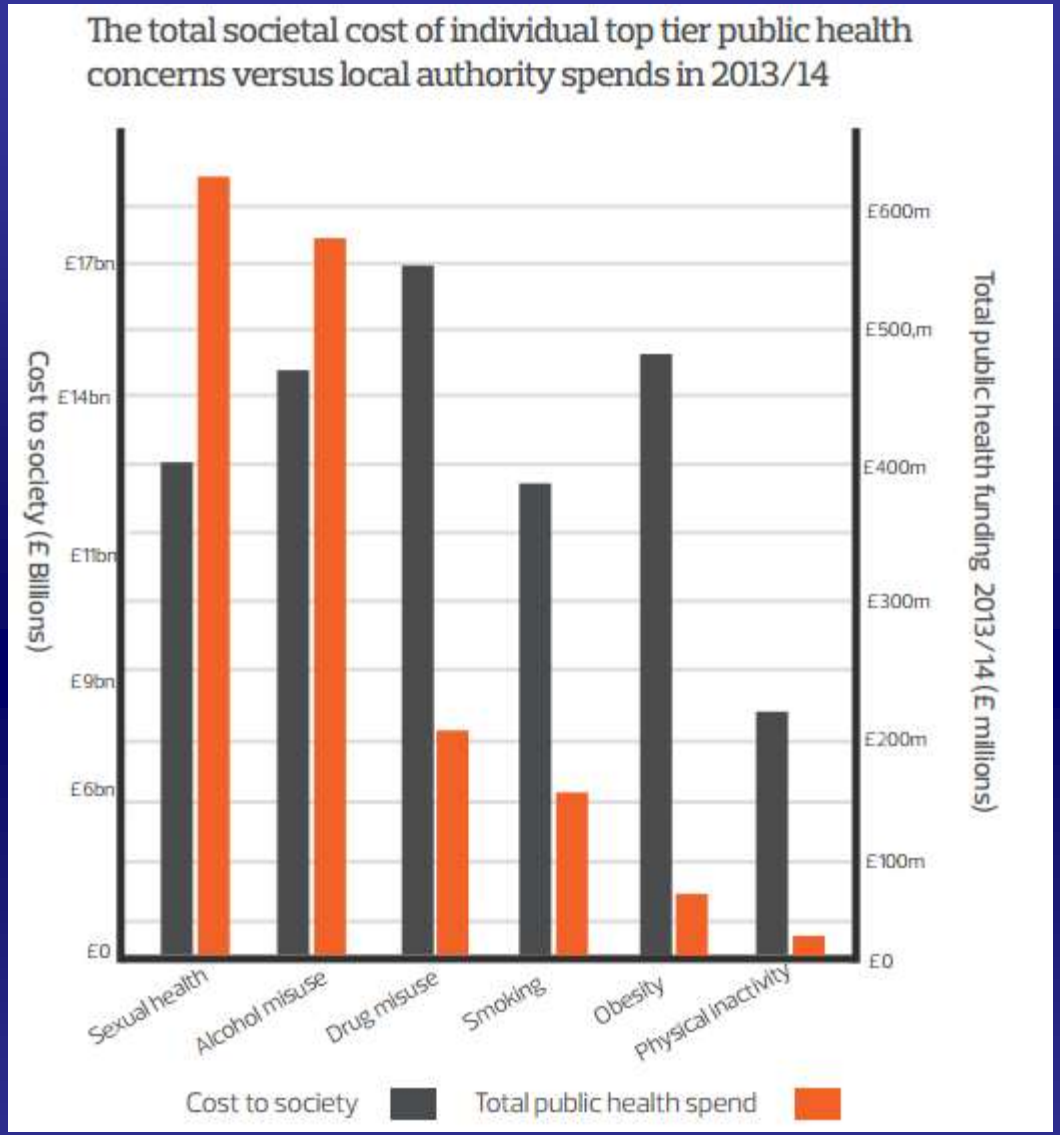
Figure **. The energy balance: weight gain, weight loss and weight maintenance

Physical Inactivity

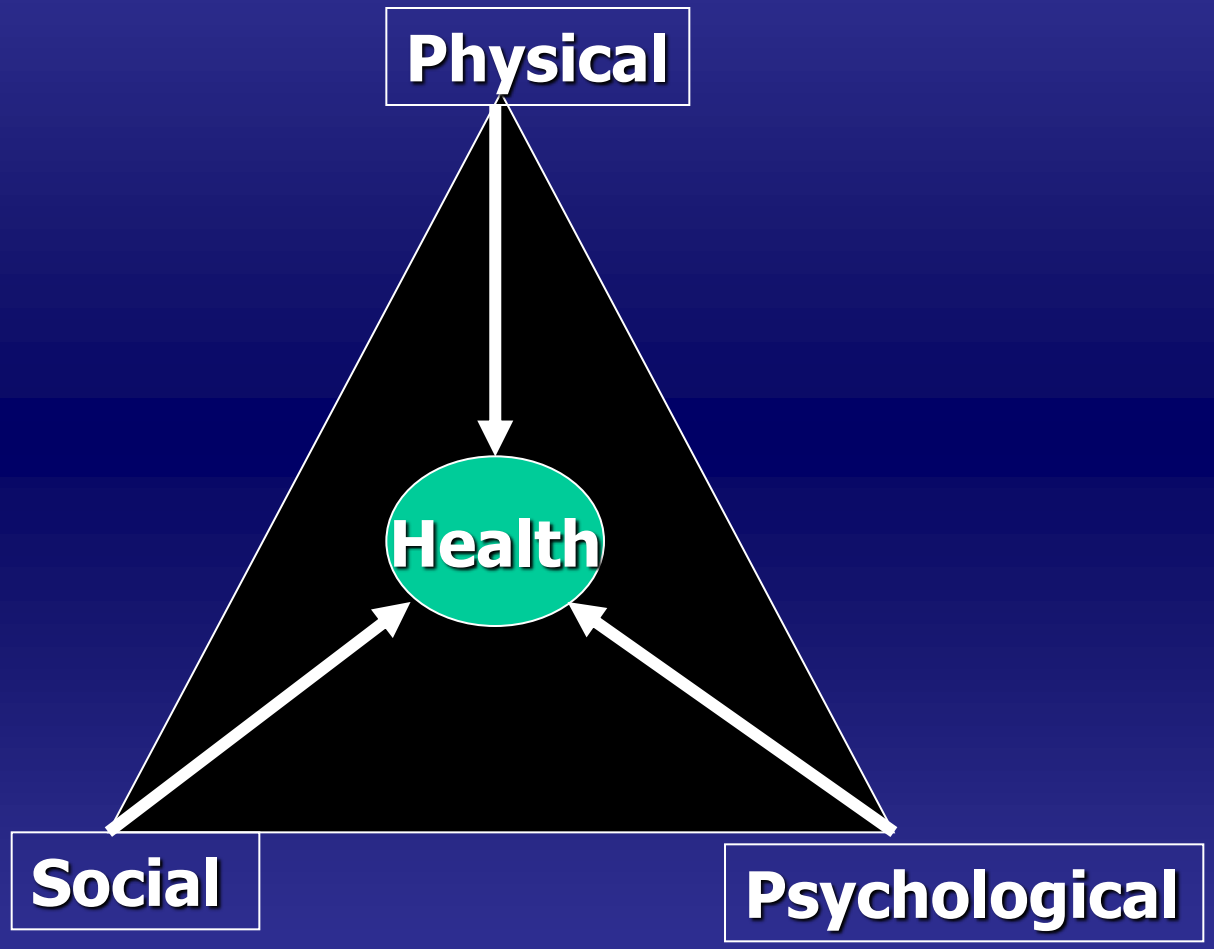
Physical Inactivity is one of the most important public health problems of the 21st Century.

Blair, S., BJSM 2009

- Physical inactivity accounts for *c.*16% of all death in women & men
- Only 39% of men and 29% of women in UK meet min physical activity recommendations (only 5% when measured objectively!)
- Annual cost of inactivity (England) = £8.2 billion + impact of inactivity on obesity = £2.5 billion
- Inactivity carries the same risk for CVD as smoking
- How often in physical activity/CV fitness assessed in medicine?


The total societal cost of individual top tier public health concerns versus local authority spends in 2013/14
Cost to society (£ Billions)
£17bn
£14bn
£11bn
£9bn
£6bn
£0
Total public health funding 2013/14 (£ millions)
£600m
£500,m
£400m
£300m
£200m
£100m
£0
Sexual health
Alcohol misuse
Drug misuse
Smoking
Obesity
Physical inactivity
Cost to society
Total public health spend

PA: Multi-Dimensional Benefits



Physical Activity & Health

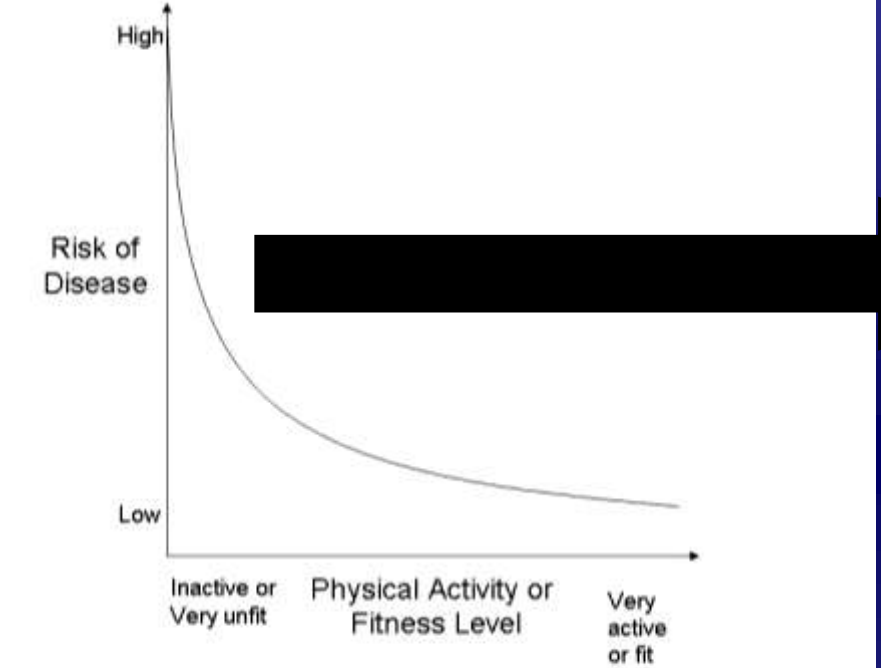


Figure *. The dose-response curve demonstrating the relationship between physical activity and risk of chronic disease – The more you exercise the less likely you are to develop a chronic disease

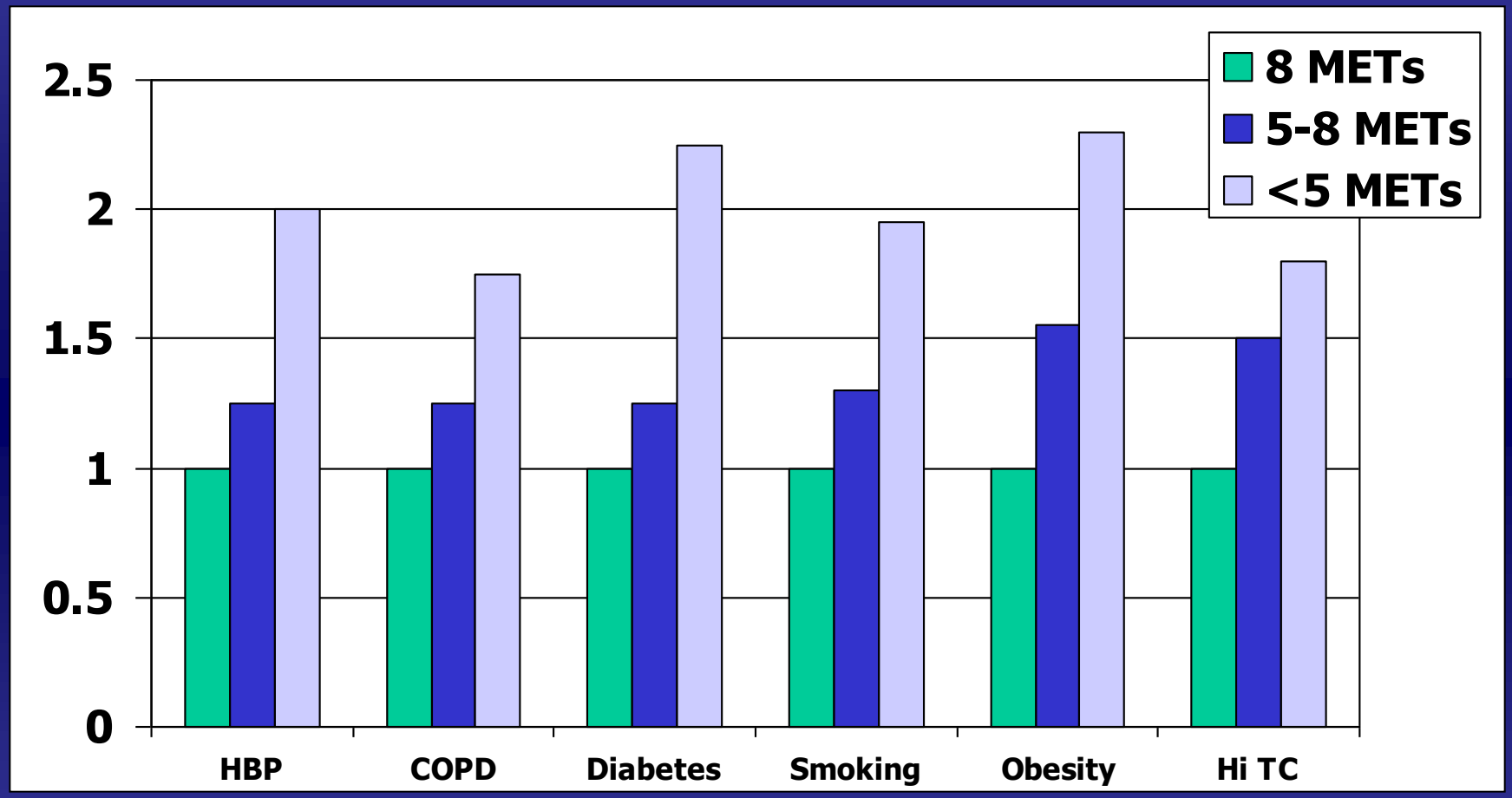
Physical

Metabolic Syndrome
- Insulin sensitivity
-Type II Diabetes
CVD
Stroke
Cancer
Asthma (pulmonary disease)
Hypertension
Hyperlipidemia
Orthopaedic incl.
- abnormal bone growth,
- degenerative disease,
- pain

Psychological

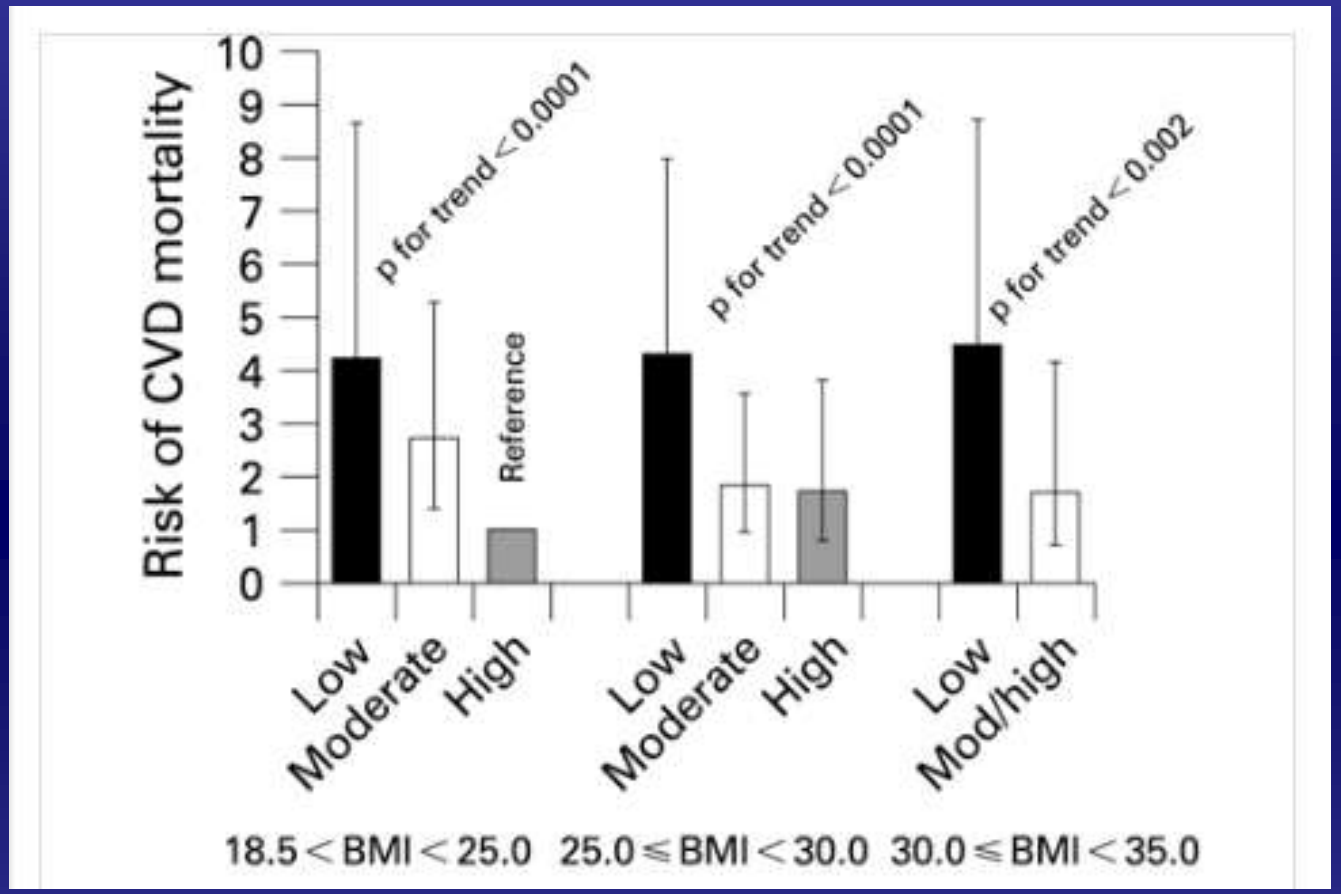
Low Self-Esteem
Depression
Suicidal ideation
Substance abuse

Relative risk of premature death & aerobic fitness



Myers et al., 2002 *NEJM;* 346: 793

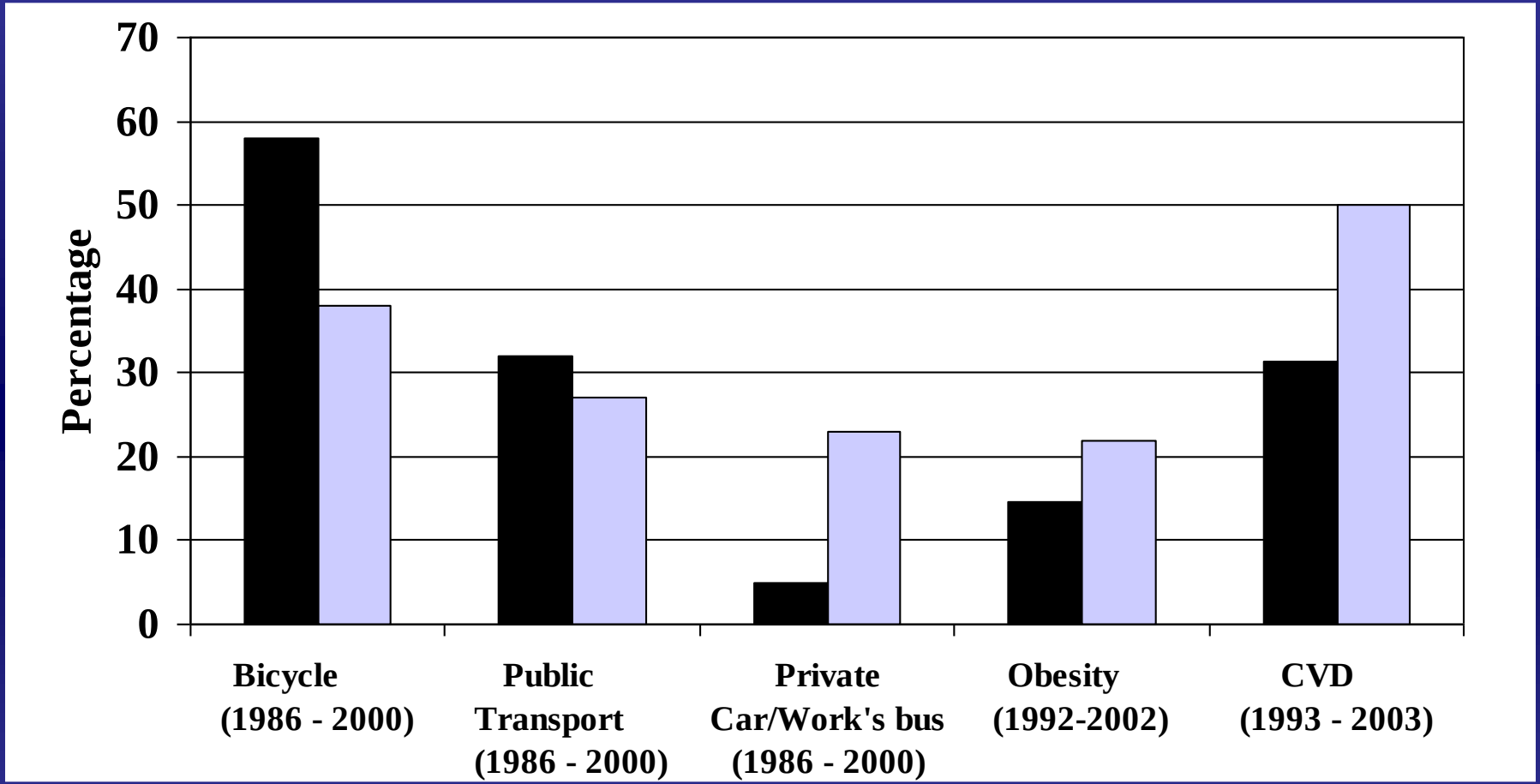
Physical Inactivity



Risk of CVD mortality by CV fitness and BMI, 2,316 men with Type 2 diabetes

Church *et al.* Arch Int Med 2005;165:2114-20

Transport, Obesity & CVD in China (1986 -2003)



Peng, 2005; Wang et al., 2006

PA and Insulin Sensitivity

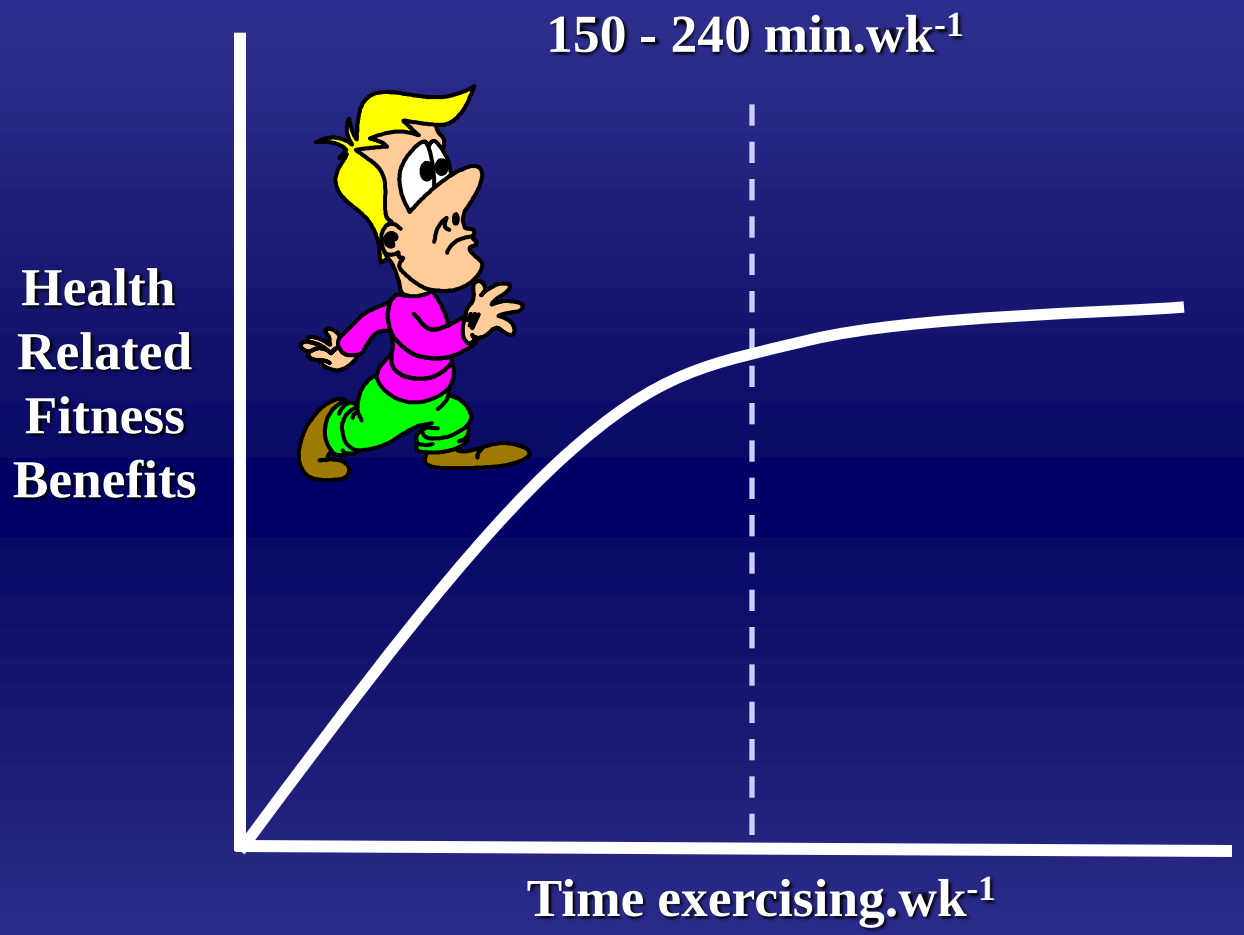
- PA improves metabolic control & insulin sensitivity
- Changes in insulin sensitivity occur independent of weight
- Suggested, PA might function to decrease hepatic and muscle insulin resistance and increase glucose disposal
- Dose dependent response
- Resistance training (RT) is effective (increase in muscle GLUT4)

Mann, S. *et al. Diabetes & Metab Res Rev.* 2013

Physical Activity & Obesity

- Reduction in volume of subcutaneous adipose tissue
- Increased mobilisation of adipose tissue
- Increased muscle lipolysis
- Lowered drive to overeat following activity
- Increased muscle mass
- Increased metabolic rate and fat oxidation
- Increased mobility
- RT & Aerobic effective

Recommendations



Pate et al., *JAMA*; 273: 402-407, 1995

Exercise Prescription

- 30 min.day^{-1} of moderate intensity physical activity (talk but not sing!)

ANY ACTIVITY, NO MATTER HOW SMALL, IS BETTER THAN SITTING STILL

INCREASE OVERALL DAILY ENERGY EXPENDITURE
NEAT + EXERCISE

- Strength and flexibility 2 episodes.wk^{-1}
- Individual specific (*i.e.* age; experience; preferences)











Research Institute for Sport & Exercise Sciences

FACULTY OF SCIENCE

liverpool JMU

CHHP
CENTRE FOR HEALTH & HUMAN PERFORMANCE

Research Institute for Sport & Exercise Sciences
FACULTY OF SCIENCE

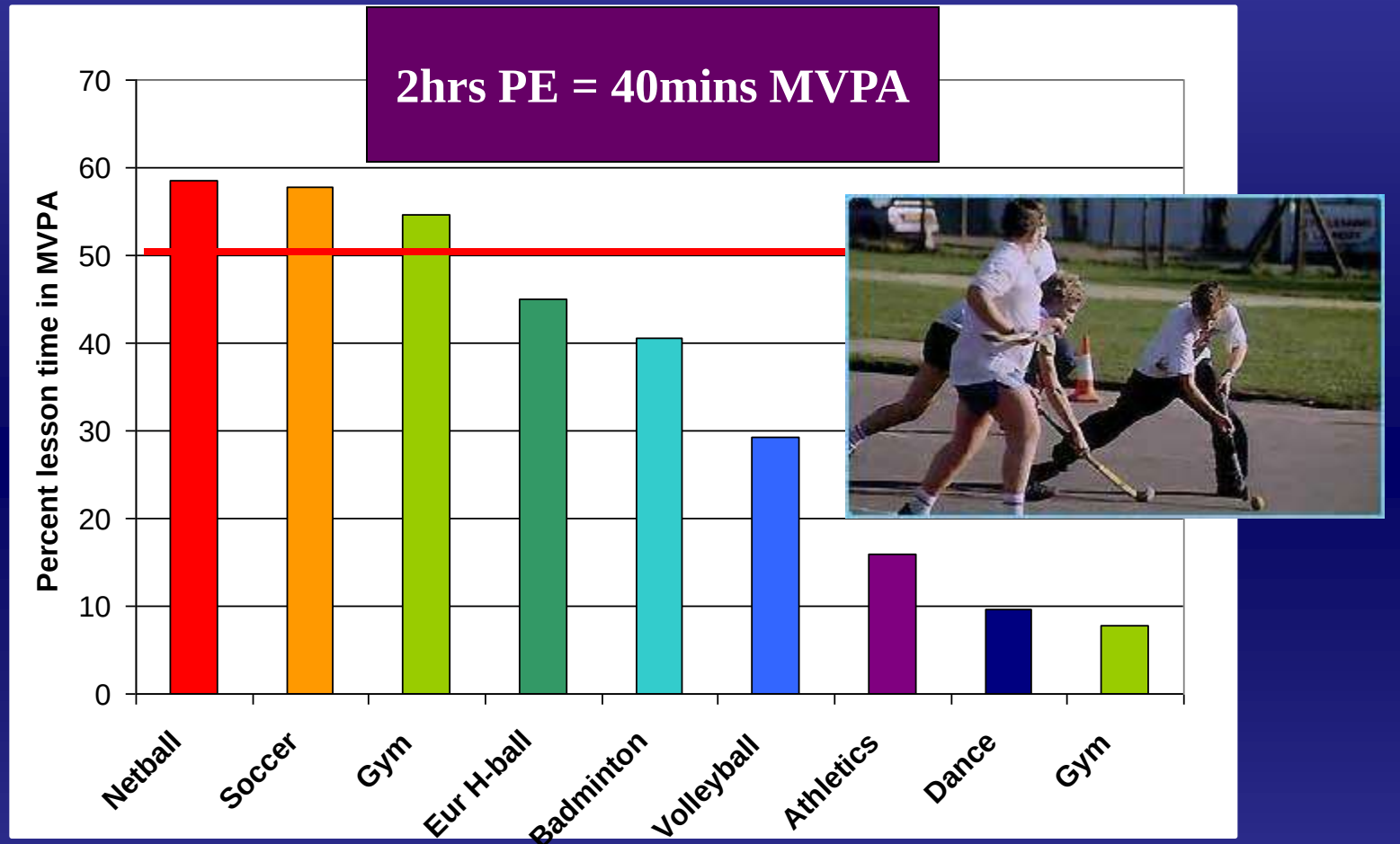
liverpool JMU

PA in the Workplace

- 4 x 30 minutes/week walking for 8 weeks
- Increased VO_{2max}, reduced CRP
- Improved physical capacity and CV health

Hewitt, J., Whyte, G. et al. *J Occup Med Toxicol* 2008;3:1-10.

Physical Activity during Physical Education



Stratton, G. (1997). JTPE. 16, 357-368.

CHHP
CENTRE FOR HEALTH & HUMAN PERFORMANCE

Research Institute for Sport & Exercise Sciences
FACULTY OF SCIENCE

liverpool JMU

CONCLUSIONS

Weight Management = Energy Balance

PA even for the severely obese (BMI>35) for about 2.5 hrs.wk^{-1} at moderate intensity or 75 min..wk^{-1} at vigorous levels increases average life expectancy above that of a sedentary normal-weight person.

PA improves metabolic control & insulin sensitivity independent of weight

Target goal of 30 min of moderate intensity exercise, 5 days.wk^{-1}, **BUT**, anything is better than nothing

The goal is to identify the type of exercise and the environment that optimises volume and long-term adherence

THANK YOU