

## Socioeconomic Factors, Work and Chronic Diseases

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Winnie, a 100-years old British women



Davey-Smith *Int J Epidemiol* 2011



### Leading Causes of Death: WHO 2030 scenario

- High-income countries
  - Ischaemic heart disease (15.8%)
  - Cerebrovascular disease (9.0%)
  - Lung cancer (5.1%)
  - Diabetes mellitus (4.8%)
  - COPD (4.1%)
- Low-income countries
  - Ischaemic heart disease (13.4%)
  - HIV/AIDS (13.2%)
  - Cerebrovascular disease (8.2%)
  - COPD (5.5%)
  - Lower respiratory infections (5.1%)

Mathers et al. *PLoS Med* 2006

### WHO 2011: Leading risk factors globally for mortality

- All deaths (40%)
  - Raised blood pressure (13%)
  - Tobacco use (9%)
  - Raised blood glucose (6%)
  - Physical inactivity (6%)
  - Overweight and obesity (5%)
- Deaths from ischaemic heart disease (>75%)
  - Heavy drinking
  - Smoking
  - Raised blood pressure
  - Overweight and obesity
  - High cholesterol
  - Raised blood glucose
  - Low fruit and vegetable intake
  - Physical inactivity

Socioeconomic factors???  
 Work???

### Classification of CVD risk (QRISK®2): UK

- Patient age (35-74).
- Patient gender.
- Current smoker (yes/no).
- Family history of heart disease aged <60 (yes/no).
- Existing treatment with blood pressure agent (yes/no).
- Body mass index (height and weight).
- Systolic blood pressure (use current not pre-treatment value).
- Total and HDL cholesterol.
- Self-assigned ethnicity.
- Rheumatoid arthritis.
- Chronic kidney disease.
- Atrial fibrillation.
- Townsend score (postcode-based measure of neighborhood deprivation)

<http://www.pafiem.co.uk/>

## Neighbourhood socioeconomic disadvantage: the Grid Database

Grid dimension 250 m x 250 m



1. Median income
2. Education (basic, %)
3. Unemployment rate

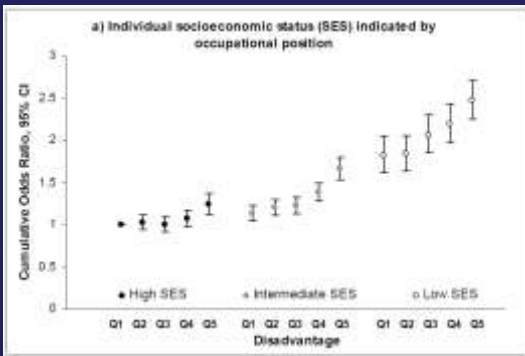
Statistics Finland: Population Statistics

- Coordinates for the participants' addresses (n=60 964) from Population Register Center



- Using GPS-coordinates, employees linked to their neighbourhoods (grid database: 18 704 neighbourhoods)
- Health risk behaviours:
  - > Smoking
  - > Heavy drinking
  - > Physical inactivity

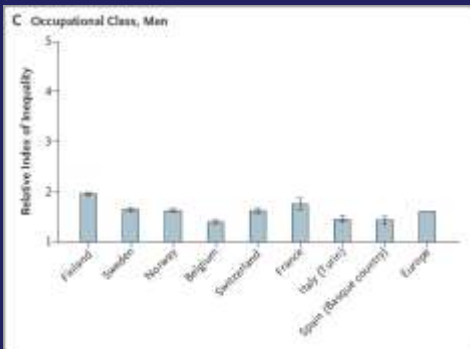
## Neighbourhood socioeconomic effects in clustering of life-style risk factors



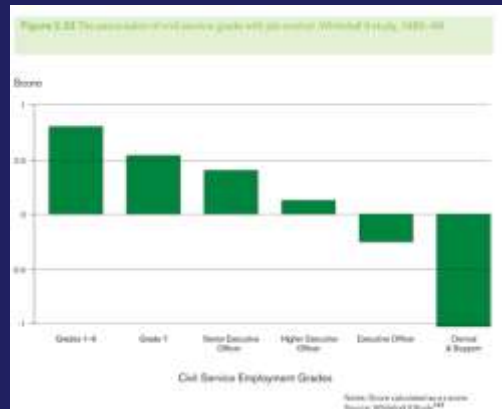
Halonen, et al. (2012) PLOS ONE



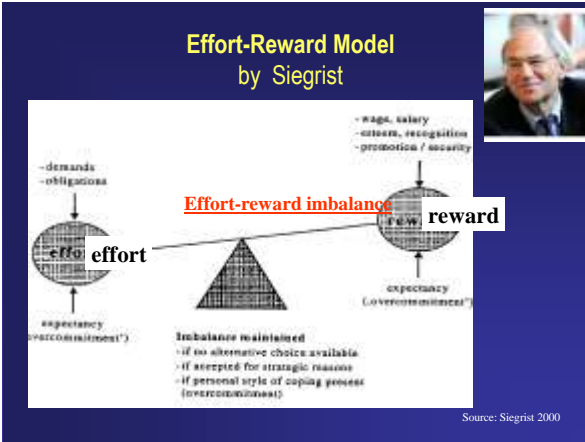
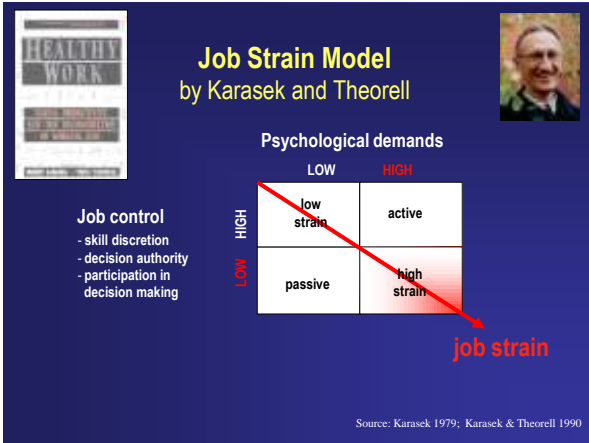
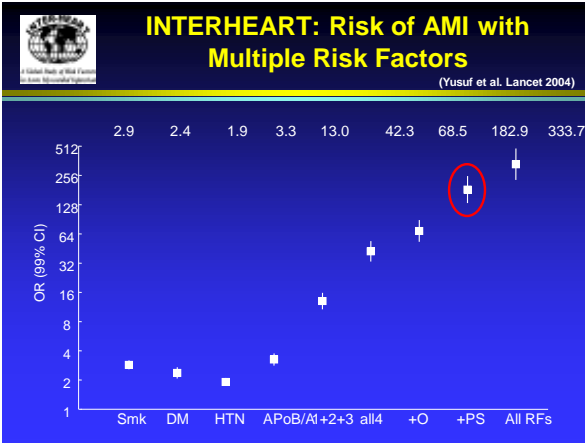
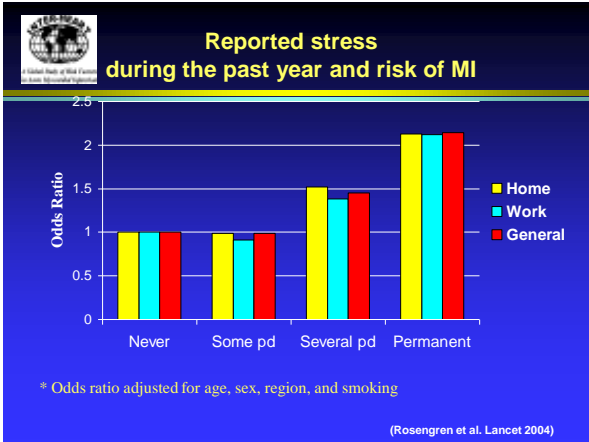
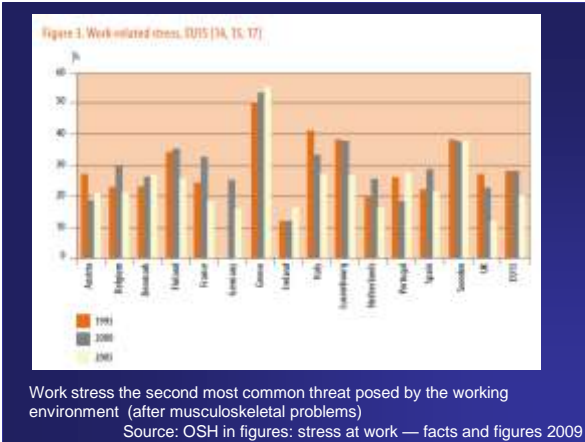
## Relative inequalities in the rate of death from any cause by occupation



Mackenbach et al. N Engl J Med 2008



Marmot Review: Fair society, healthy lives



- Organizational injustice theory**
- **Procedural justice:** fairness of procedures used (decision criteria, voice, control of the process; the rules are applied equally for everyone)
  - **Relational justice:** fairness of the interpersonal treatment received (dignity and respect; deals with employees in a truthful manner)
- Moorman 2001, Greenberg & Cropanzano 2001

## Work stress and IHD\*: Meta-analysis of prospective cohort studies

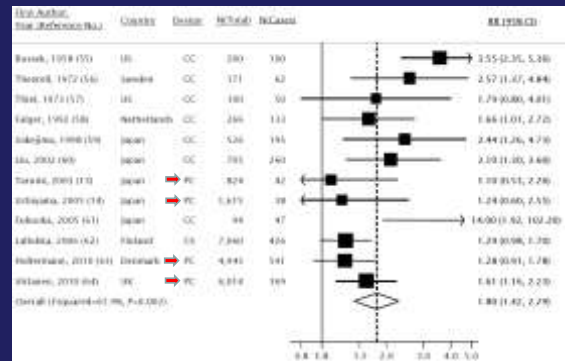
Stress model	Age- and sex-adjusted	Multiple adjusted**
Job strain	1.45 (1.15 to 1.84)	1.11 (0.91 to 1.35)
Effort-reward imbalance	2.52 (1.63 to 3.90)	2.51 (1.58 to 3.98)
Organizational injustice	1.62 (1.24 to 2.13)	1.47 (1.12 to 1.95)

\*summary estimates

\*\*risk factors and potential mediators

Kivimäki et al. *Scand J Work Environ Health* 2006

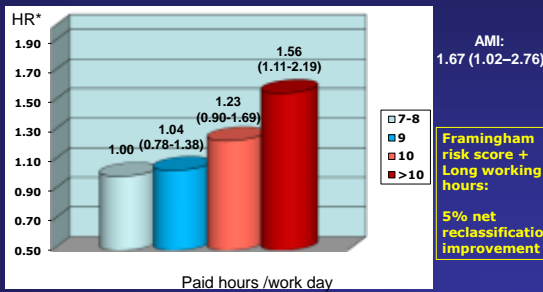
## Long working hours and CHD: meta-analysis



Virtanen et al. *Am J Epidemiol* 2012

## Overtime and CHD: Whitehall II

6014 civil servants free from CHD and worked full time at baseline  
CHD: fatal/non-fatal MI or angina pectoris (11-year follow-up)



\* Adjusted for demographics, diabetes, diastolic blood pressure, LDL and HDL cholesterol, triglycerides, type A behaviour

Virtanen et al. *Eur Heart J* 2010  
Kivimäki et al. *Ann Intern Med* 2011

## The Telegraph

Monday April 4, 2011

Hard work won't kill you? Well it might actually. It is often said that "hard work won't kill you".



## CNN

Long hours at work may boost heart-attack risk  
By Amanda Gardner, Health.com  
April 4, 2011 - Updated 2143 GMT (0543 HKT)



## Mail

April 5, 2011



## UK NEWS

Heart risk of long hours

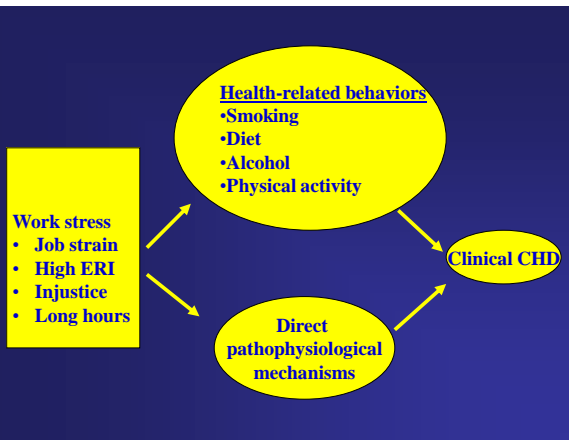


Long hours at work increase heart risk

APRIL 5, 2011

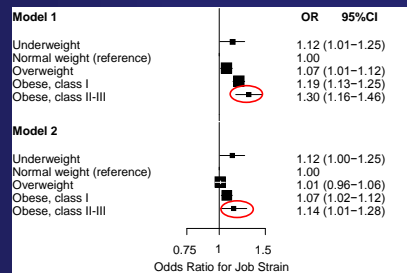


Kivimäki et al. *Ann Intern Med* 2011



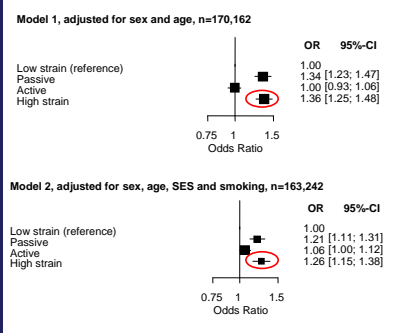
## Job strain and BMI: The IPD-Work Consortium

- Pooled analysis of 14 prospective European cohort studies (Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden, UK)
- >170,000 participants (49% men, mean age 44 years).



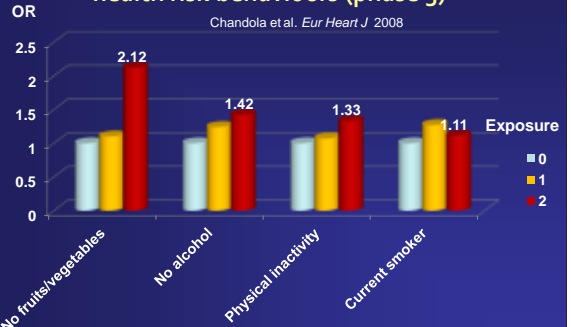
Nyberg et al. *Journal of Internal Medicine* 2011

## Job strain and physical inactivity: The IPD-Work Consortium



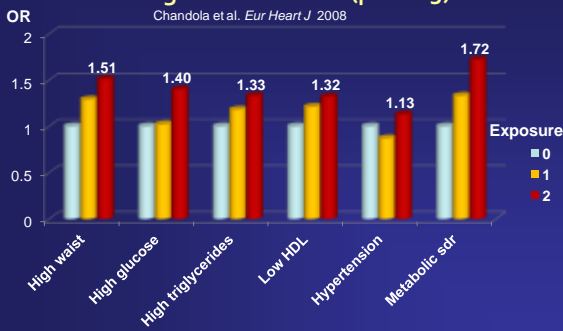
Fransson, et al. (submitted)

## Cumulative work stress (phases 1-2) and health risk behaviours (phase 3)



Life-style explained 16% of the association between work stress and IHD

## Cumulative work stress (phases 1-2) and biological risk factors (phase 3)



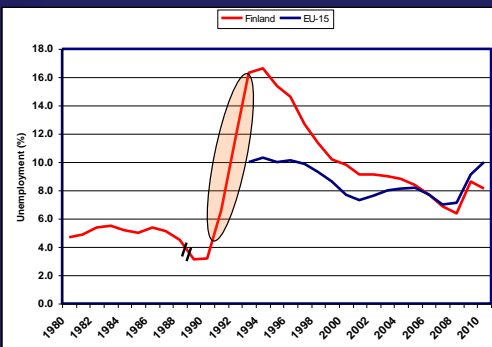
Physical inactivity, poor diet and the metabolic syndrome the most important explanatory factors (32% of the association)

## Efforts to strengthen causal inference:

### 1. Using experiments of nature

(exposure random in relation to characteristics of individuals)

## Unemployment rate (%) in Finland



Statistics Finland, Eurostat



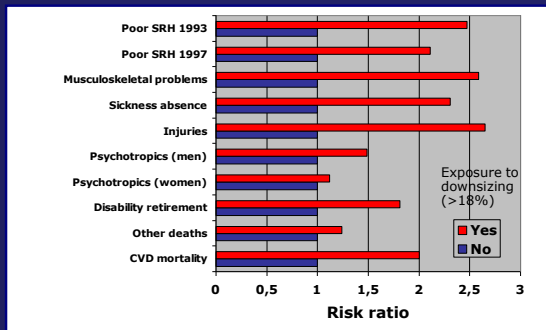
## Quasi-experiment

All 26 682 employees from 4 towns  
Study population (29 had missing data)  
Organisational downsizing 1991-1993

Non-downsized group n = 17 599    Downsized group n = 4783    Those lost/left job n = 4271

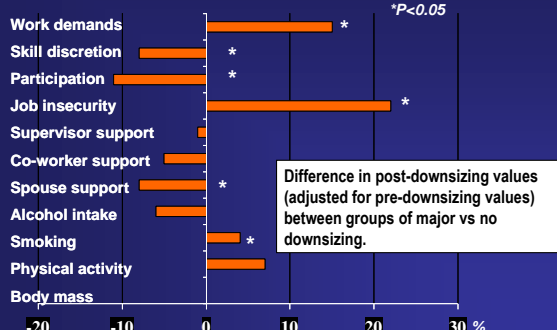
Outcome: Health status in 1994-2000

## Post-downsizing health problems among "survivors"



Vahtera et al. *Lancet* (1997), *BMJ* (2004), *JECH* (2005); Kivimäki et al. *OEM* (2001), *BMJ* (2004), *JECH* (2007)

## Validation: Downsizing as a proxy measure of work stress



Kivimäki et al. *BMJ* 2000

## Efforts to strengthen causal inference:

### 2. Using repeated measurements

(individuals their own controls)

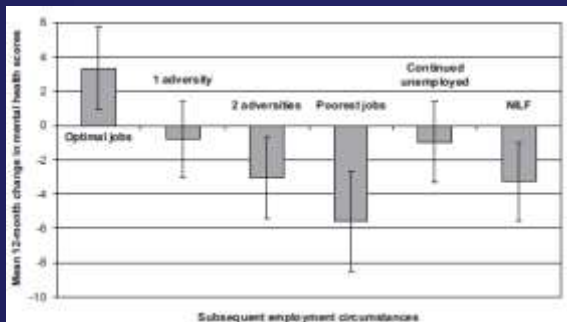
## Employment circumstances and mental health

- > Household, Income and Labour Dynamics in Australia (HILDA), a nationally representative annual household panel survey (7,155 respondents)
- > Seven waves of data
- > Longitudinal random-intercept regression models regressing mental health on time-varying employment circumstance
- > Adjustments for demographics, education, years in employment, physical functioning (SF-36), financial difficulties, neighborhood disadvantage

	Model A	Model B Add covariates	Model E Lagged predictors of change in mental health
Employment continuum			
Optimal job	5.95 (0.33)***	5.77 (0.33)***	6.27 (0.78)***
1 Adversity	4.10 (0.32)***	4.06 (0.32)***	4.28 (0.78)***
2 Adversities	2.42 (0.32)***	2.32 (0.32)***	2.89 (0.82)***
Poorest jobs	(Ref)	(Ref)	(Ref)
Unemployment	-0.07 (0.55)	1.26 (0.55)*	3.89 (1.32)*
NLF	0.49 (0.32)	2.07 (0.38)***	2.20 (0.81)**

Source: Butterworth et al. *Occup Environ Med* 2011

## Change in mental health for transitions from unemployment



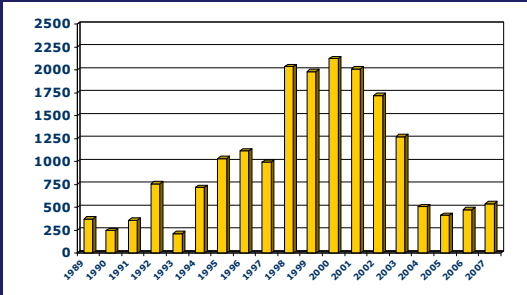
Source: Butterworth et al. *Occup Environ Med* 2011

## Efforts to strengthen causal inference:

### 3. Removal of all work-related stress

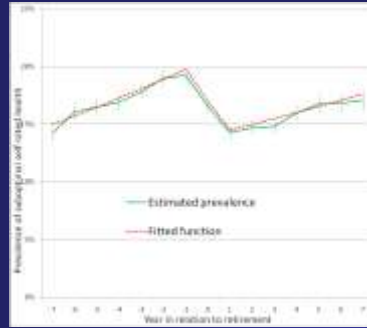
("intervention study")

### Number of employees retiring in the Gazel cohort by year of retirement



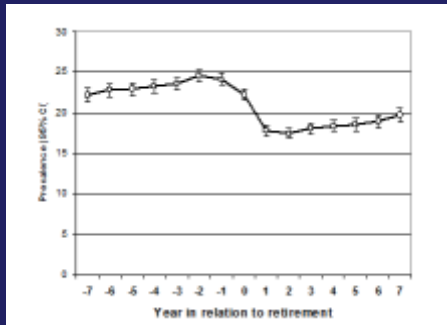
18,884 (92%) retired by 2007.  
 All participants with repeated measurement on health before and after retirement  
 Employees retire early (mean age 55 yrs) and benefit from good social security (pension 80% of salary)

### Trajectory of prevalence of suboptimal self-rated health



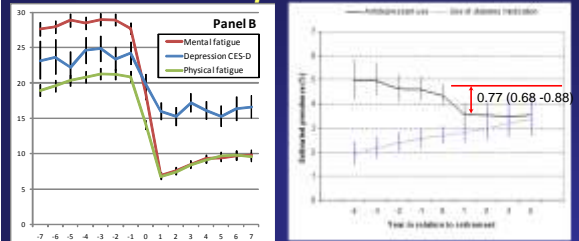
Westerlund et al. *Lancet* 2009

### Trajectory of prevalence of sleep disturbances



Vahtera et al. *SLEEP* 2009

### Trajectory of prevalence of fatigue and depression

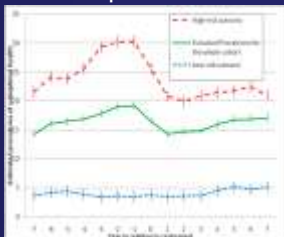


Westerlund et al. *BMJ* 2010

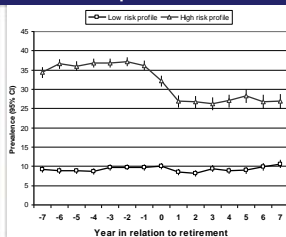
Finnish public sector employees  
 • 7138 statutory retirees (mean age at retirement 61.2 yrs).  
 • Purchases of antidepressant medication derived from comprehensive national pharmacy records in 1994-2005.  
 Oksanen et al. *Epidemiology* 2011

### Explanations for the trajectories

#### Suboptimal health



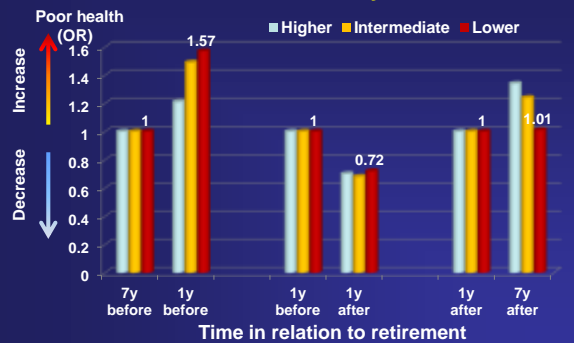
#### Sleep disturbances



Westerlund et al. *Lancet* (2009)

Vahtera et al. *SLEEP* (2009)

### Changes in suboptimal health around retirement by SES



Westerlund et al. *Lancet* 2009

## Characteristics associated with cardiovascular health

- No use of tobacco
- Adequate physical activity:
  - at least 30 minutes 5 times a week
- Healthy eating habits
- No overweight
- Blood pressure below 140/90
- Blood cholesterol below 5 mmol/L
- Normal glucose metabolism
- **Avoidance of excessive stress**



European Heart Health Charter designed to prevent cardiovascular disease (developed by the European Heart Network and the European Society of Cardiology, with the support of the European Commission and WHO. <http://www.ehnheart.org>)

## Extended working lives?



## Best-practice interventions

Pharmacological and lifestyle interventions have reduced

- systolic blood pressure by about 10 mm Hg,
- total cholesterol by 2 mmol/L,
- blood glucose among pre-diabetic people by 1 mmol/L, and have halved the prevalence of non-insulin-dependent diabetes mellitus (non-IDDM) in adults.

In principle, all smokers could quit.

**What would happen to socioeconomic inequalities if the best-practice risk reductions applied to both high and low socioeconomic groups?**

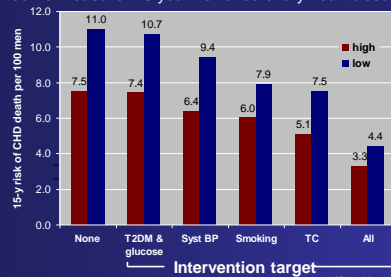
Kivimaki et al. *Lancet* 2008;372:1648-54.

## Best-practice interventions applied universally

17 186 male civil servants aged 40–69 years at baseline (1967-1970; Whitehall study).

**Baseline measures:** Socioeconomic position based on employment grade, systolic blood pressure, total cholesterol, postload glucose/diabetes, smoking.

**Main outcome measure:** 15-year risk of coronary heart disease mortality



Kivimaki et al. *Lancet* 2008;372:1648-54.