University of California Los Angeles
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The importance of work for health: A personal introduction

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Background

- The modern world of work and employment is full of far-reaching challenges of the health and well-being of working people and the functioning of businesses and economies.

- Rapid technologic advances, economic globalisation with associated intense competition, financial risks, job insecurity, political upheaval and the global climate crisis are just most telling examples.

- There is a need to be concerned about the negative aspects of modern work for human health, and to strengthen the positive aspects.

- Scientific research offers the leading approach towards this analysis. Importantly, its results can instruct measures of prevention and policies of healthy work (e.g. UN Sustainable Developmental Goal 8).

Positive aspects of paid work for human health and well-being

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Being employed or self-employed is a major goal in adult life. It determines a wide range of life chances:

- It provides continuously earned income and economic independence
- It confers a social status within society and strengthens a person‘s social identity, providing formal membership and basic social security
- It structures time, strengthens motivation and pro-active behaviour
- With good quality, It offers opportunitios for skill development, training and promotion
- With good quality, it meets important human needs of autonomy, self efficacy, recognition, and related self- esteem
- Satisfaction of these needs directly strengthens human health and well-being

Negative aspects of paid work for human health and well-being

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- Work absorbs a major part of adult human life time. With poor quality, it causes long-standing frustration, distress and exhaustion
- With poor quality, work adversely affects health and well-being through exposure to material and psychosocial stressors
- If not self- determined, work restricts the development of personal skills and opportunities of flourishing
- With its long working hours and inflexible schedules, work limits opportunities of private and family life and the satisfaction of related needs
- Given its economic constraints, work prevents alternative, not employment-related ways of autonomous living

Scientific analysis of work and health: Two approaches

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How does work impair your health? Two main scientific traditions:

- Physical / chemical/ biological factors:

Photo by Yury Kim from Pexels

Injury	Disability
Hearing loss	Heavy noise
Dust (e.g. asbestos)	Lung disease, Cancer
Heavy lifting	Back pain

- Psychosocial factors:

Photo by fauxels from Pexels

Long working hours	CVD?
High work pressure	Hypertension?
Job loss	Depression?

Modern work: A major role of the Psychosocial Work Environment

- In the sectors of service and ICT occupations/professions, as well as in automated industrial production, non-material (psychomental and socio-emotional) job tasks are much more prevalent than material (e.g. manual work, lifting, carrying) job tasks.

- ‚Psychosocial Work Environment' is an umbrella term to describe these non-material job task and employment conditions of modern work.

- Effects of non-material working conditions on the working person are processed through the brain's sensory input, the cognitively and emotionally appraised information (subjective experience).

- Psychosocial Work Environments are defined at the meso-social level (characteristics of organisations, job tasks, employment contracts etc.).

How does the Psychosocial Work Environment affect the working persons?

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- It recurrently generates stimuli (‚stressors') that are perceived as threats by the working person.
- Threat:
  - a perceived physical or interpersonal assault or harm (violence. mobbing, discrimination);
  - a perceived loss of control over one's agency (failed performance)
  - a perceived offense of one's social identity (depreciation, job loss)
- Threats evoke negative emotions in the cortico-limbic brain structures:
  - Behavioural reactions (‚fight-flight', coping activities)
  - Activation of physiological stress responses (SAM-, HPA axis)
- If chronically experienced in everyday working life, stressors often bypass cognitive awareness (‚habituation'), yet activate the cortico-limbic structures.

How to identify stressors of the Psychosocial Work Environment ?

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- The complexity of the many dimensions needs to be reduced by selecting an analytical focus
- An analytical focus is guided by the scientist‘s theoretical interest that identifies a few crucial dimensions of threat at a high level of abstraction (to be applied to as many occupations as possible)
- Examples of crucial dimensions are ‚demand‘, ‚effort‘, ‚resource‘, ‘control‘, ‚reward‘, ‚support‘, ‚insecurity‘, ‚injustice‘.
- A theoretical model consists of a set of hypotheses that specify the interaction between these dimensions to explain or predict their effects on health.
- Empirical tests of the model‘s measurement determine its scientific significance

Theoretical models of psychosocial work with relevance to health

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- There are a number of proposed theoretical models of psychosocial work and health, but few models only meet all of these four criteria:

1. Explanatory contribution:
   Examination by prospective epidemiological investigations, supported by evidence on psychobiological pathways
2. Assessment:
   Validated measurement approach meeting psychometric quality criteria
3. Strength of evidence:
   Independent replications of results, including diverse health outcomes
4. Generalization:
   Application to different occupations, sectors, policy contexts; extension of basic notions beyond paid work

Four complementary models of a stressful psychosocial work environment

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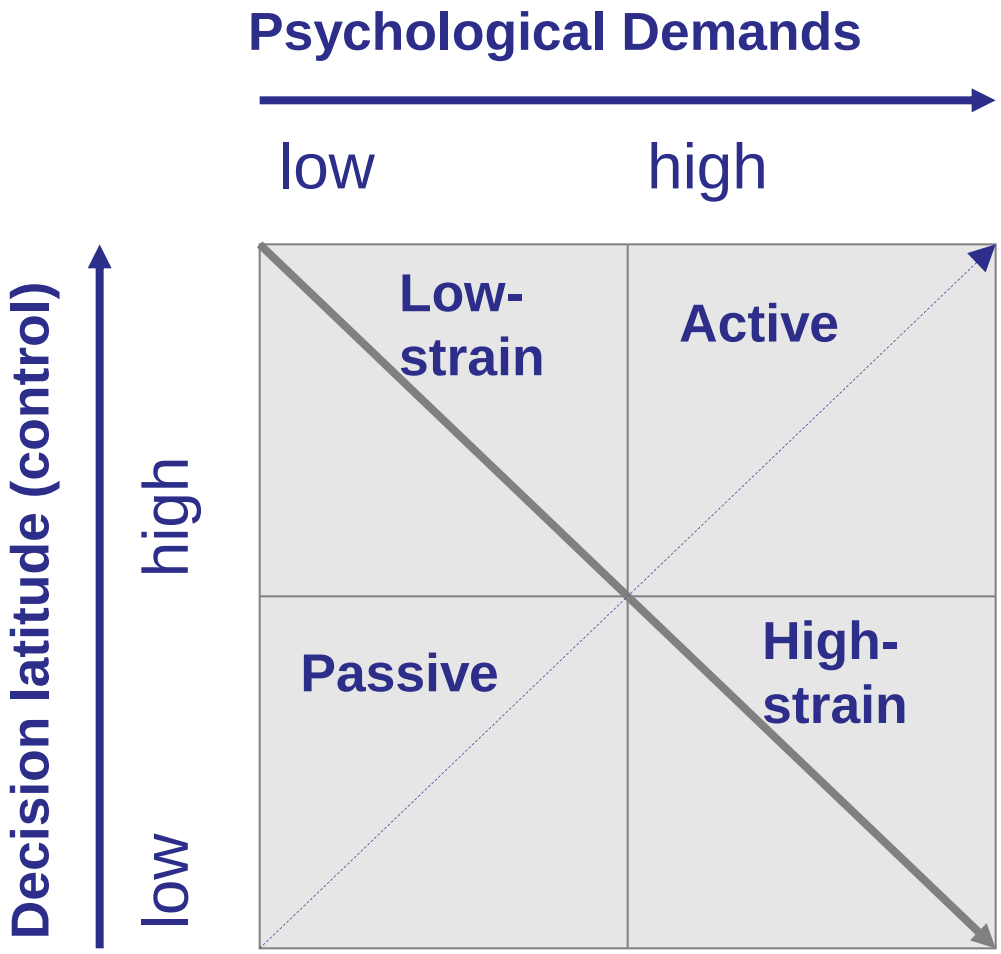
- Demand-Control
  (R. Karasek, 1979;
  R. Karasek & T. Theorell, 1990)
  - ➢ Focus on job task profile: high demand/low control
- Effort-Reward Imbalance
  (J. Siegrist, 1996;
  J. Siegrist et al., 2004)
  - ➢ Focus on work contract: high effort/low reward
- Organizational Injustice
  (J. Greenberg et al.,1982;
  M. Elovainio et al., 2002)
  - ➢ Focus on unfair procedures and interactions
- Job Demands-Resources
  (A. Bakker, E. Demerouti, 2017)
  - ➢ Focus on protective effect of job resources (organization/person)

The Demand-Control Model
(R. Karasek 1979, R. Karasek, T. Theorell 1990)



Source: Karasek R, Theorell T (1990) *Healthy Work*. New York: Basic Books, p. 32.

The Demand-Control Model

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Core hypothesis:

- High demand in combination with low control generates stressful experience with longer-term elevated risks of stress-related disorders

Explanatory contribution:

- Prediction of increased cardiovascular, metabolic and mental health risks (and some additional disorders); quasi-experimental evidence on psychobiological pathways (SAM, HPA-axis).

Assessment:

- Validated Job Content Questionnaire JCQ (Karasek et al. 1998)

Strength of evidence:

- Multiple independent replications of findings in prospective studies

Generalization:

- Application in rapidly developing coutries; extension to work at home

The Effort-Reward Imbalance (ERI) Model
(J. Siegrist 1996)

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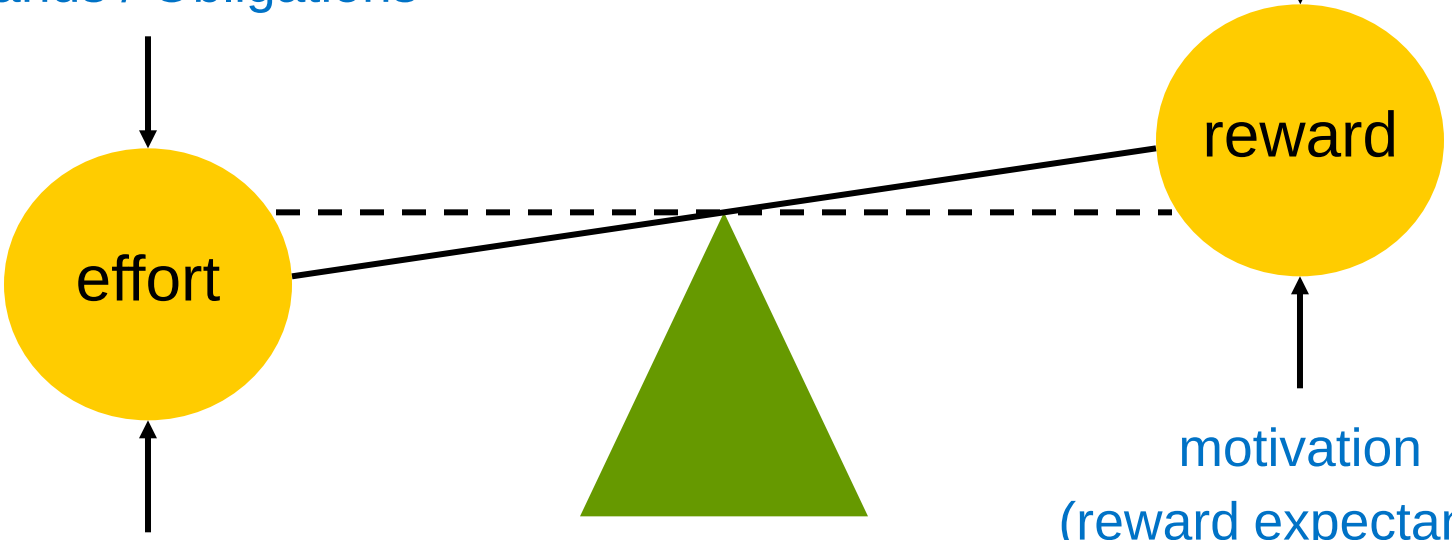
Situational components

- Money: wage, salary
- Status: mobility / job security
- Recognition: esteem

Demands / Obligations



motivation
(reward expectancy)

motivation
(over-commitment)

Personal component

Source: Based on Siegrist, J (1996): *J Occup Health Psychol*, 1: 27-41.

The Effort-Reward Imbalance (ERI) Model

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Core hypothesis:

- In addition to single components the joint manifestation of high effort and low reward generates stressful experience with elevated risks of longer-term stress-related disorders

Explanatory contribution:

- Prediction of increased cardiovascular, metabolic and mental health risk; quasi-experimental evidence on psychobiological pathways (SAM, HPA-axis; inflammation, immunity).

Assessment:

- Validated ERI Questionnaire (Siegrist et al. 2004); short version since 2010

Strength of evidence:

- Multiple independent replications of findings in prospective studies

Generalization:

- Application in rapidly developing coutries; extension to voluntary work, family work, educational work

Development of the ERI model:

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- It started by listening to some 380 middle-aged men who survived their first myocardial infarction (MI) in extensive interviews conducted as a research team in a cardiac rehabilitation clinic in 1977-78.
- In many reports, a disruptive event threatening a core social role (mainly work role) occured before the onset of MI, always in a context of exhaustive work. Prepared by sociological reasoning, the idea of a new feature of psychosocial stress at work emerged.
- We compared this pattern among the 380 post-MI sample with a healthy control sample (N=190) and found significant differences, as expected (J. Siegrist et al. 1982; Soc Sci Med 16, 4543-453).
- Findings were corroborated in a longitudinal study of 416 blue-collars followed 6.5 years. Main finding: Combination of indicators of high effort and indicators of low reward: 4 times more often among new cases of MI than among the remaining sample (Siegrist et al. 1990; Soc Sci Med .31(10),1127-34).
- After a long process of critical inquiry, the reference publication of the model appeared in 1996 (J. Siegrist 1996, J Occup Health Psychol 1, 27-41).

Aims of the lecture

- In the following part, the evolution of work stress research based on the ERI model is demonstrated, as an example of recent research developments in this field.

- The presentation will be structured according to the themes ‚Methods' and ‚Study designs':
  1. Measurement approach
  2. Epidemiological investigations
  3. Quasi-experimental and naturalistic studies
  4. Intervention studies

- The final part discusses some general science- and policy-related challenges of psychosocial work stress research in times of economic globalisation and technological revolution.

1. Measurement approach
The Effort-Reward Imbalance Questionnaire

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Original and short version:

- Scale ‚*Effort*' (6/3 Likert-scaled items) = perceived demands
- Scale ‚*Reward*' (11/7 Likert-scaled items) = experienced or promised gratifications, with 3 subscales: salary; esteem, job security
- Scale ‚*Over-commitment*' (6 Likert-scaled items) = pattern of coping
  - ‚*Ratio effort/reward*' =
    sum score ‚effort' / (sum score ‚reward' × corr.)

➢ Psychometric tests: reliability, validity; factorial structure

➢ Availablility in more athan a dozen languages

Reference; Montano D, Li J, Siegrist J (2016) The measurement of effort-reward imbalance (ERI)at work. In: Siegrist J, Wahrendorf M (eds) Work stress and health in a globalized economy (pp. 21-42). Cham: Springe Nature

The Effort-Reward Imbalance Questionnaire (short)

(Leineweber C et al. *Occup Environ Med* 2010, 67: 526)

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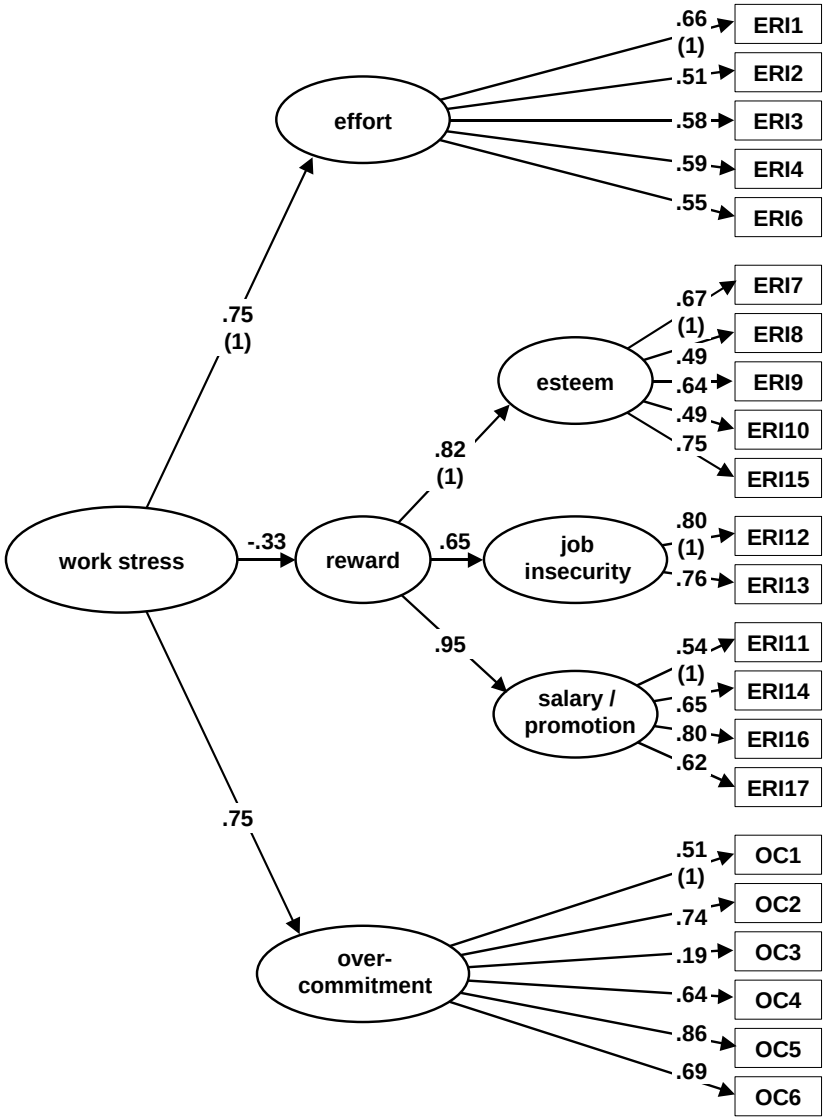
	Strongly disagree	Disagree	Agree	Strongly agree
I have constant time pressure due to a heavy work load.				
I have many interruptions and disturbances while performing my job.				
Over the past few years, my job has become more and more demanding.				
I receive the respect I deserve from my superior or a respective relevant person.				
My job promotion prospects are poor.				
I have experienced or I expect to experience an undesirable change in my work situation.				
My job security is poor.				
Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.				
Considering all my efforts and achievements, my job promotion prospects are adequate.				
Considering all my efforts and achievements, my salary / income is adequate.				

ERI: Confirmatory factor analysis



Original questoionnaire:

3 Scales: Effort, Reward, Over-Commitment.

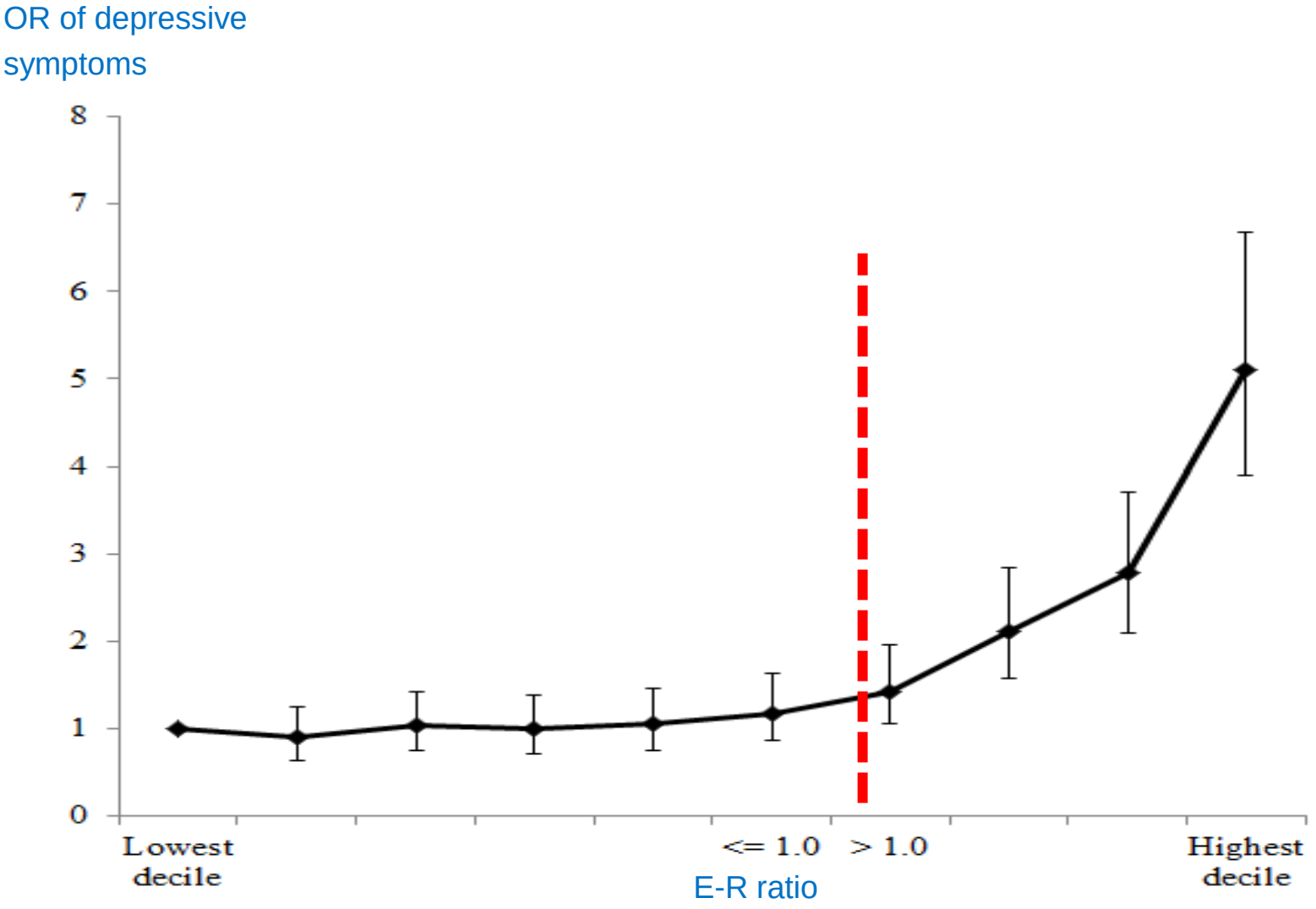
N = 666 employed men an women

χ^2/df	2,99
GFI	.91
AGFI	.89
CFI	.90
RMSEA	.06

Source: Rödel A et al. (2004) Z diff diagn Psychol 25: 227-238

The E-R ratio: Non-linear relationship with risk of depressive symptoms

German Socioeconomic panel 2016 (n = 10,919)



Source: Li J, Leineweber C et al (2019) *J Occup Environ Med* 61: 898.

2. Epidemiologic investigations

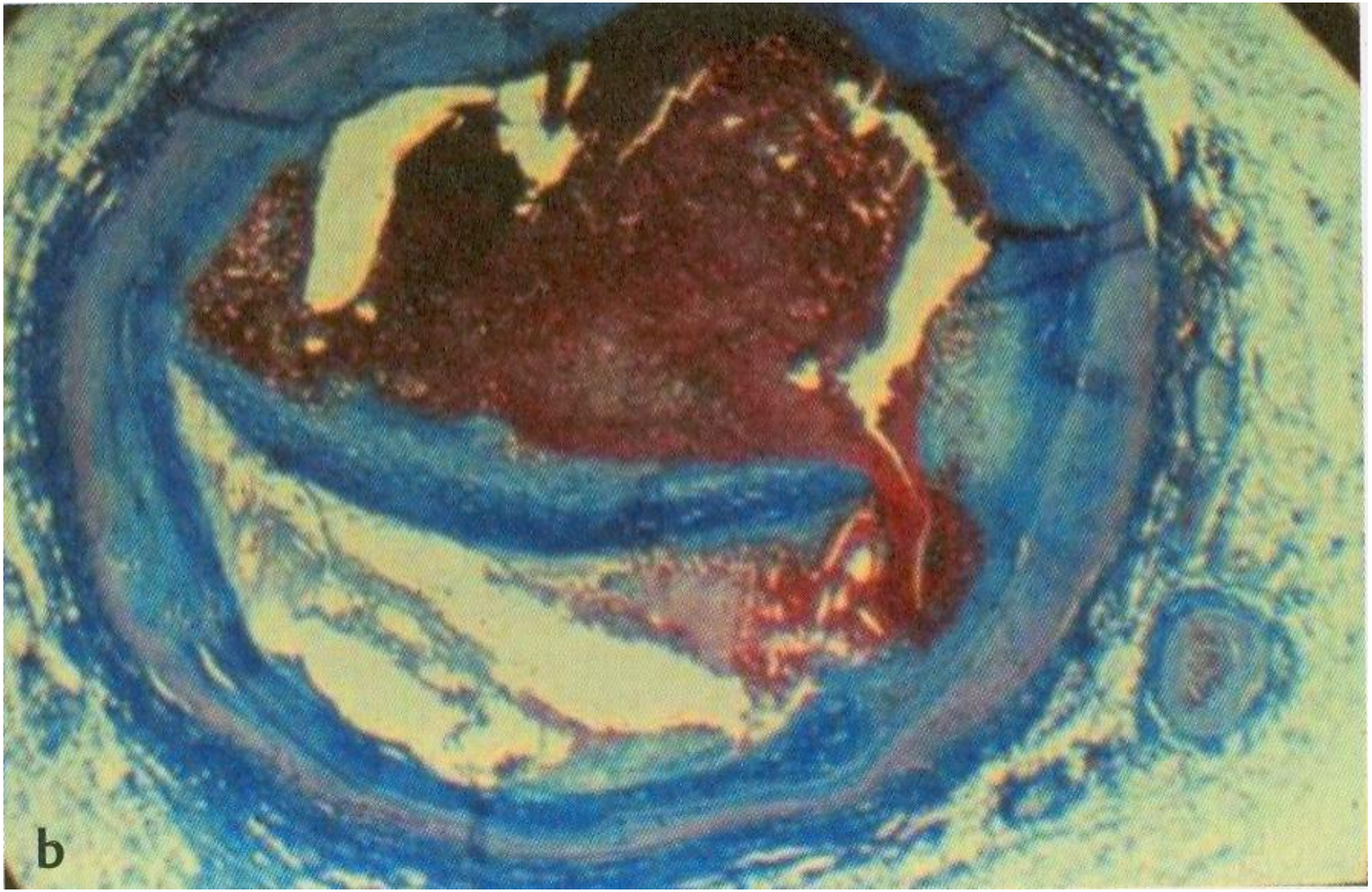
- Prospective study design
- Exposure at baseline and outcome at follow-up
- Dose-response relationship
- Statistical control of confounding factors

- Selected study findings on these outcomes:
  - Coronary heart disease*)
  - Depression*)

*) Depression and coronary heart disease are leading causes of premature mortality and of life years defined by disability (DALYs) worldwide

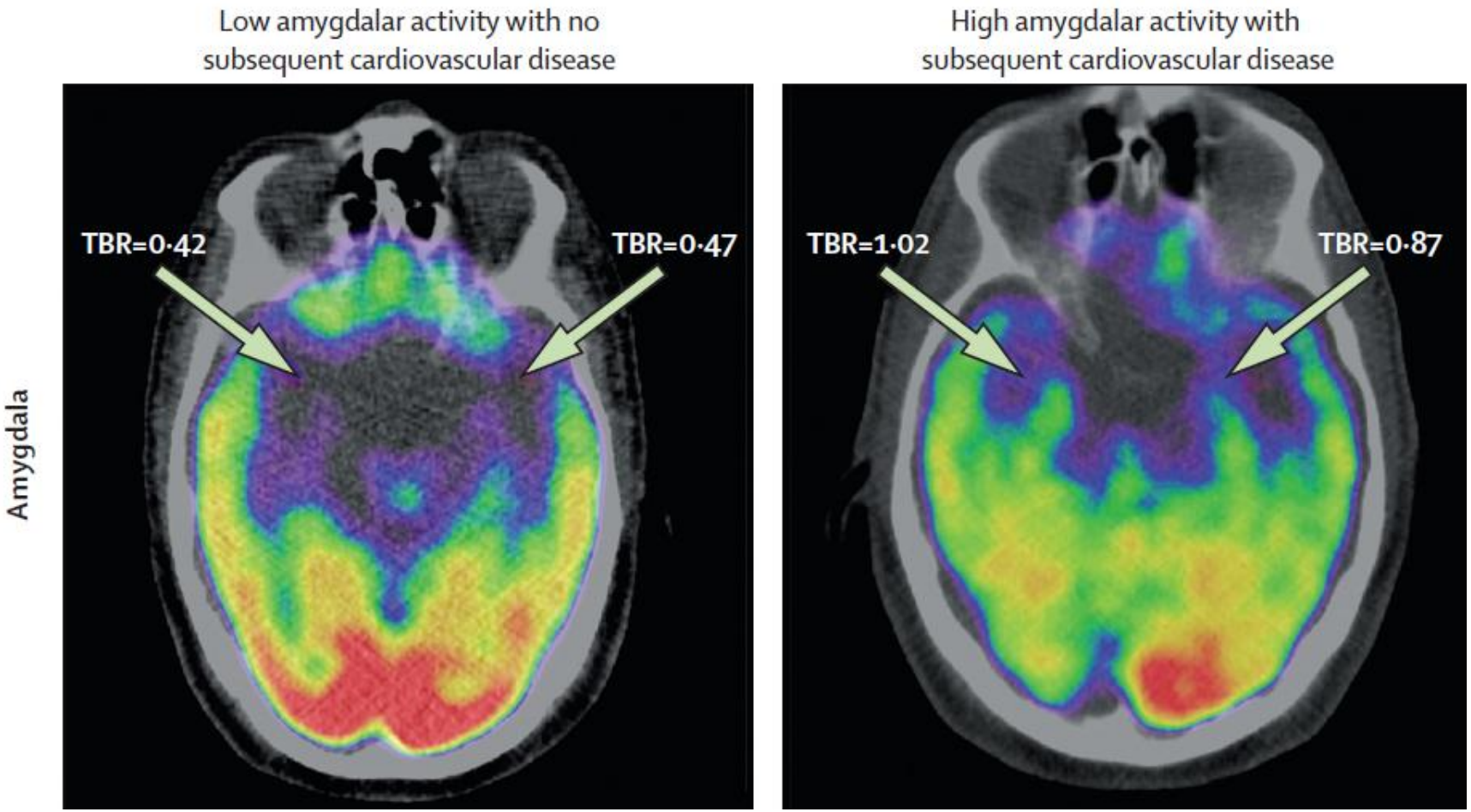
(GBD 2017; Lancet 392,1789)

Coronary heart disease (CHD): Does work stress promote atherosclerosis?



Quelle: Nixdorf U (2009) *Check-Up-Medizin*. Stuttgart

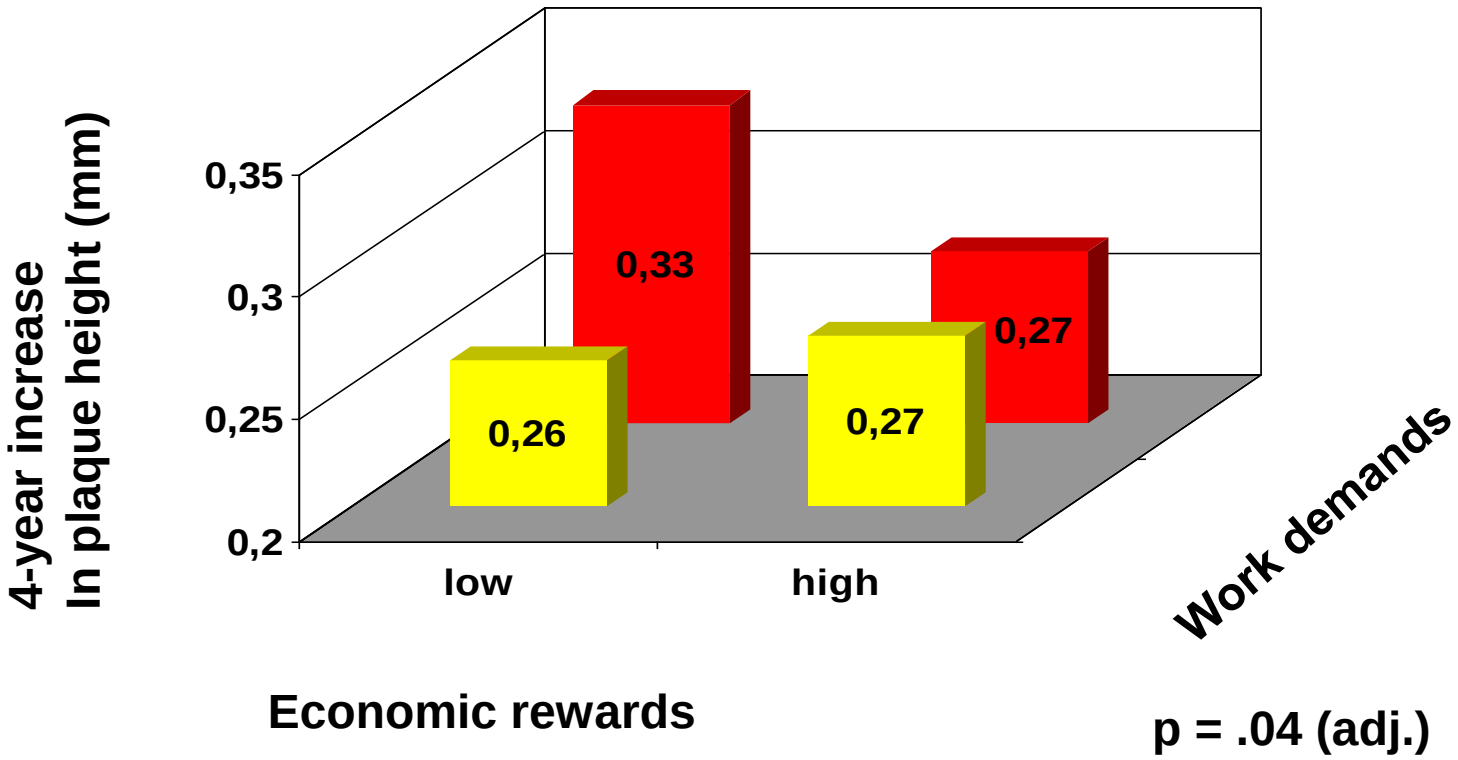
Stress, activated limbic circuits (amygdala) and elevated CVD risk



HR 1.59 (95% CI: 1.27 – 1.98) of CVD due to high activity, n = 293; 3.7 years

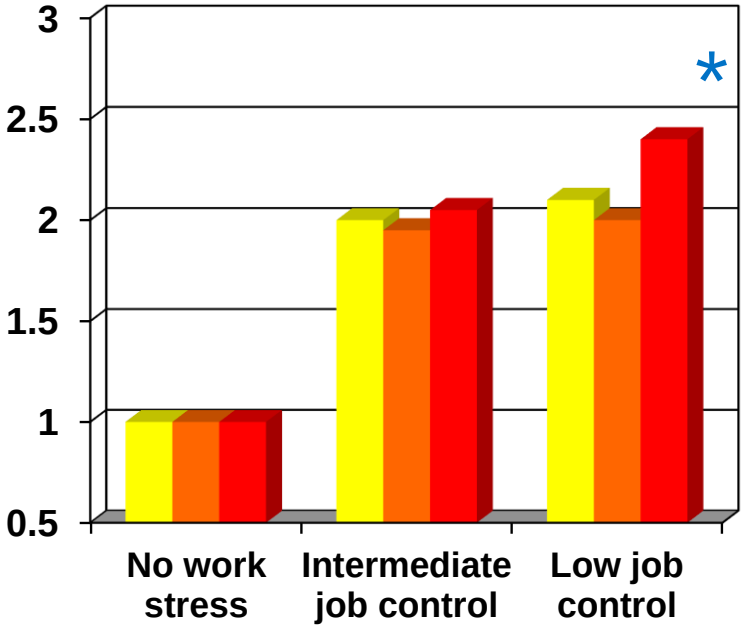
Source:Tawakol A et al. (2017) *Lancet* 389:834-45

Prospective blue-collar study: Demand/reward and progression of carotid atherosclerosis
(4-year period; N= 940 male Finnish workers)



Source: Lynch J et al. (1997), *Circulation*, 96: 302-307.

Effort-reward imbalance and job control:
CHD incidence (ORs; 9095 men and women: Whitehall II-Study)



adjusted for age, sex, length of follow-up

\+ alternative work stress model

\+ grade, coronary risk factors, negative affect

* p < .05

Source: Based on Bosma, H, et al. (1998), *Amer J Publ Health*, 88: 68-74

Combined exposure to ERI and Job strain and risk of IHD:
PROQ-Study: 18 year follow-up; N= 3118 men

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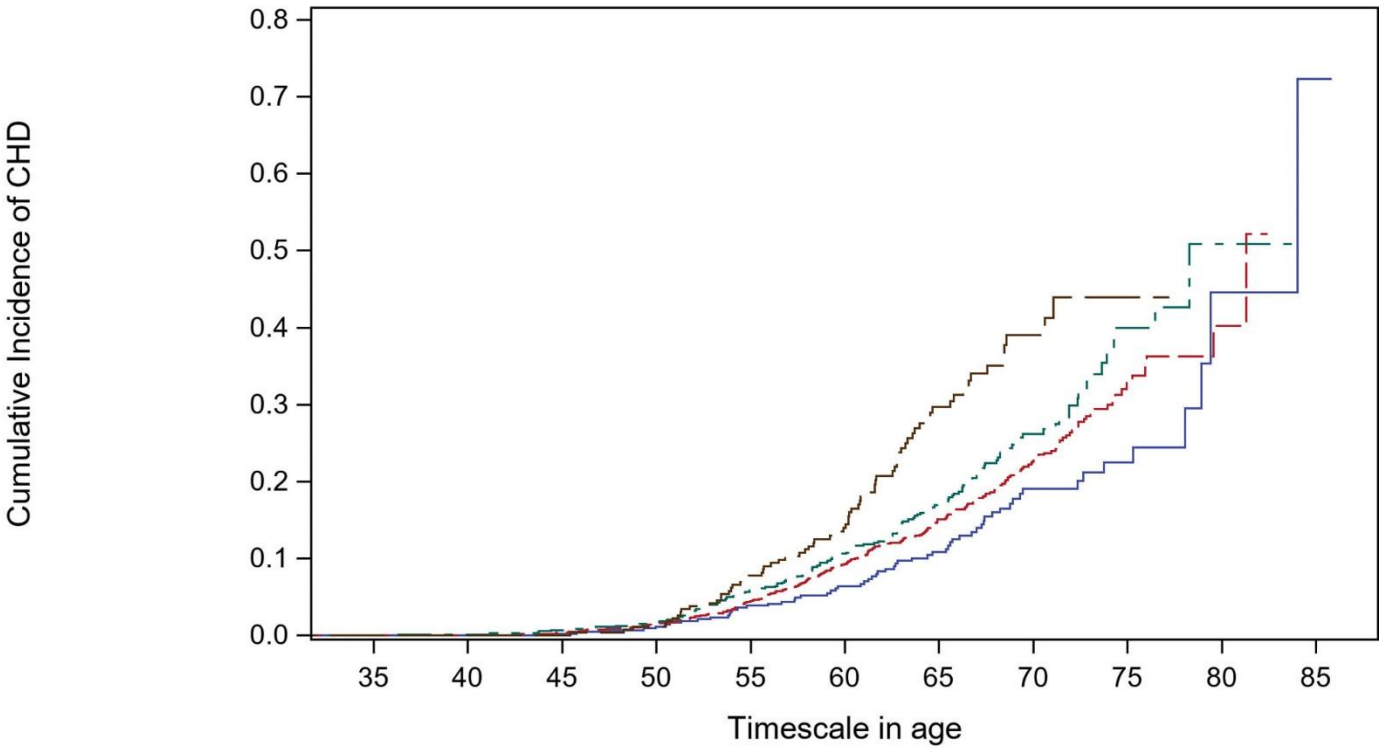
A

Kaplan-Meier survival curves for the age before coronary heart disease among men: combined exposure to job strain and effort-reward imbalance

With Number of Subjects at Risk



Unexposed	431	431	429	422	374	308	220	110	45	6	1
Low exposure	1678	1677	1671	1635	1467	1203	810	360	79	10	0
Intermediary exposure	741	740	735	720	648	516	337	130	31	3	0
Double exposure	268	268	268	261	227	172	94	30	5	0	

HR = **1.95** (1.32: 2.87), adj for 15 risk factors

Source: Lavigne-Robichaud et al. (2023) *Circ Cardiovasc Qual Outcomes 16*(10)

Prospective epidemiological evidence: Effort-reward imbalance and CVD risk

First author, year		Health outcome	RR / HR (95% CI)	
Bosma H (1998)		Incident CHD (+angina)	**2.15** (1.15; 4.01)	
Kivimäki (2002)		CVD mortality	**2.42** (1.02; 5.73**)**	
Kuper (2004)		Incident CHD	**1.26** (1.03; 1.55)	
Aboa-Eboulé (2011)		Recurrent CHD	**1.75** (0.99; 3.08)	
Dragano (2017)		Incident CHD (IPD study)	**1.16** (1.00; 1.35)	
Kivimäki (2018)		CHD mortality (non CMD)	**1.22** (1.02; 1.41)	
Lavigne-Rebouchon (2023)		Incident CHD (men)	**1.55** (1.26; 1.90)	
Siegrist (2025)		CVD mortality	**1.66** (1.08; 2.53)	

Depression

- Serious condition with high prevalence in employed populations

  (Germany: lifetime prevalence 10% men; 20 % women; ca 5 mio/year)

- Frequent onset in early adulthood and risk of recurrence

  (Germany: 50% of first episodes of unipolar depression before age of 31)

- Long duration of absenteeism

  (Germany: mean duration of sickness absence 2022: 47 days)

- Difficulties of return to work

  (Germany: each year 147.000 work years lost due to depression; high rate of disability pensions)

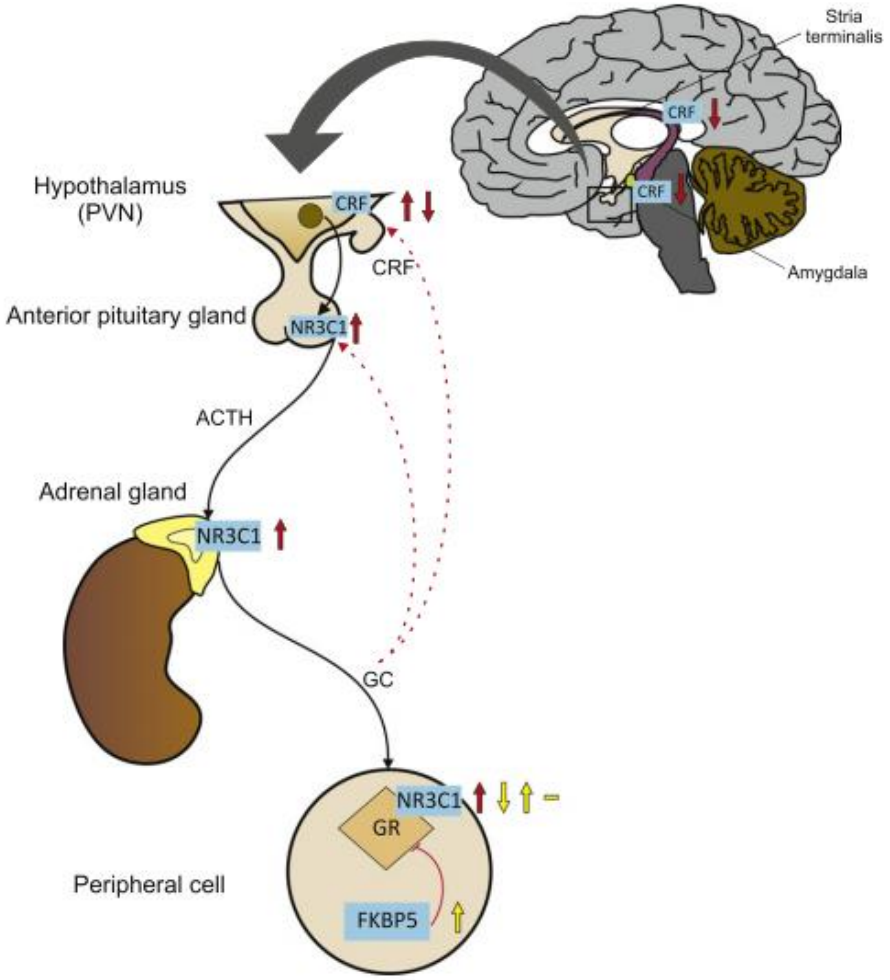
- High risk of co-morbidity and suicide

  (Cardiovascular and metabolic risk: twice as high in depression; suicide: Germany 2021: 9.215 cases (75% men); ca. 200.000 suicide attempts)

- High costs

  (Direct disease costs Germany 2020: 5.8 Billion €)

Chronic psychosocial stress and the development of depression



Excessive activation of the HPA axis with cortisol release increases epigenetic regulation of the glucocorticoid recepter gene NR3C1 and the serotonin transporter gene SLC6H4:

Links to depression: Li M et al. (2019) *Trans Psychiatry* 9:68

Source: Bakusic J et al. (2017) *J Psychosom Res* 92:34-44

Work stress and disability pension due to depression

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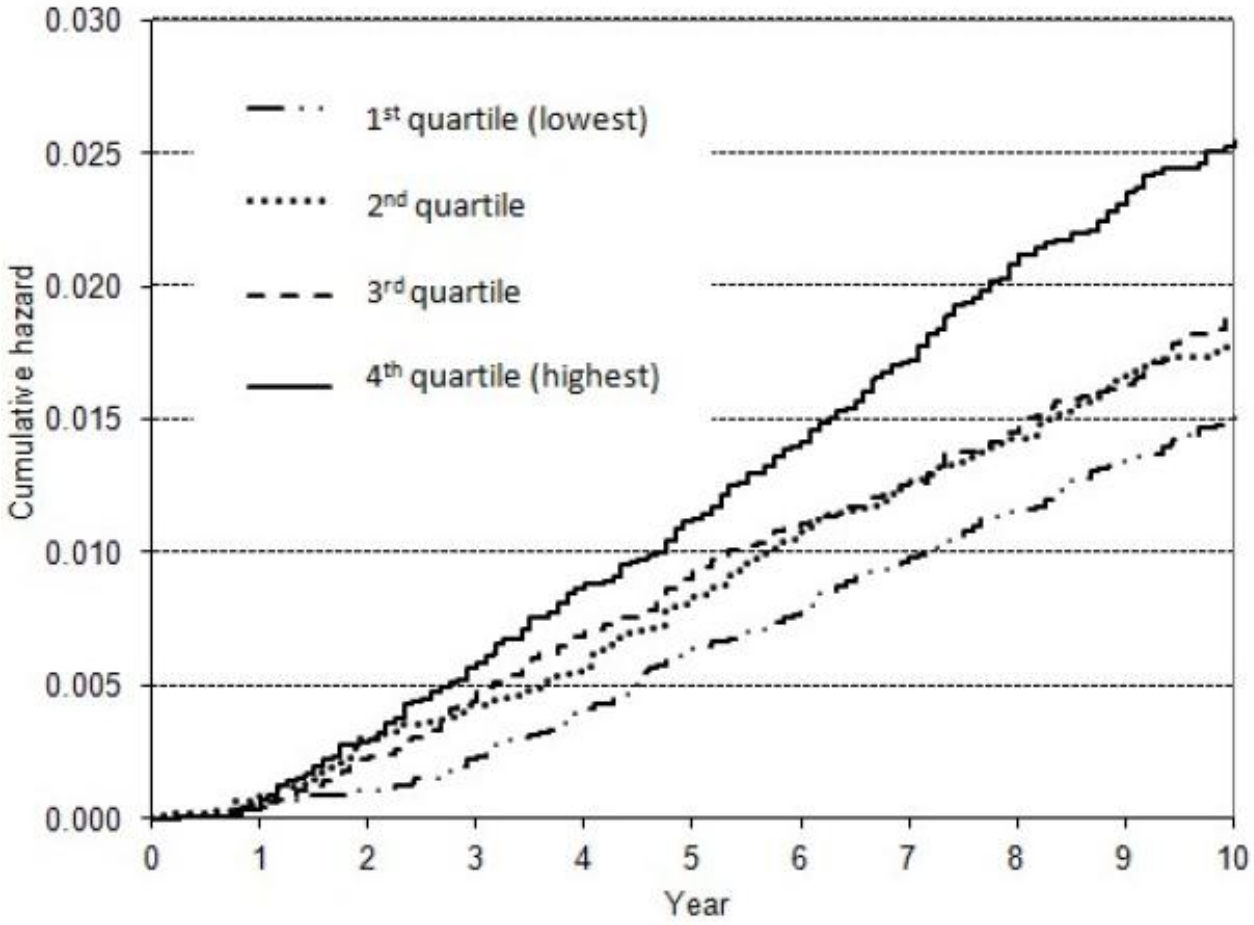
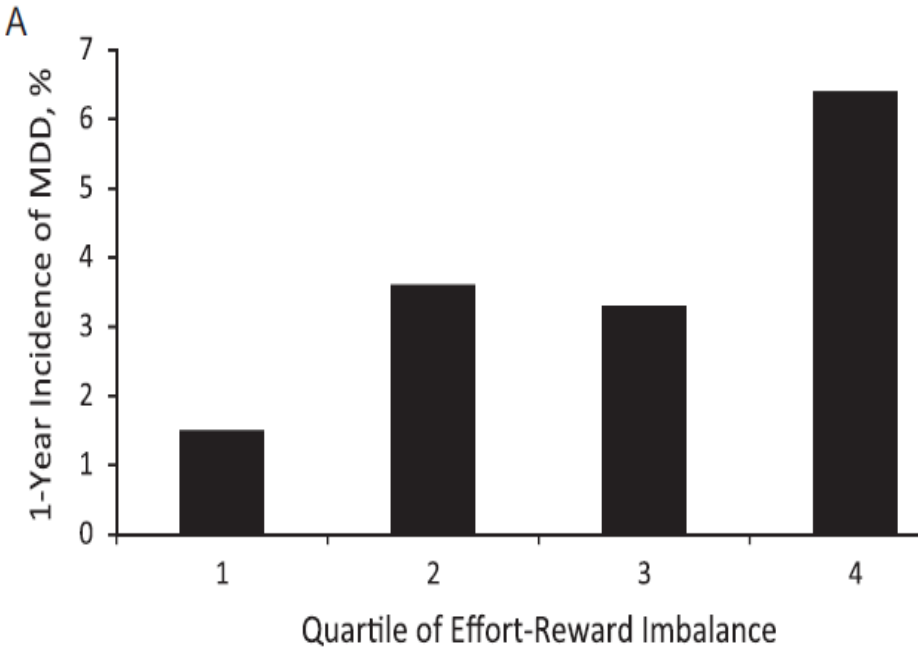
Cumulative hazard curves of disability pension due to depression by quartiles of work stress (ERI) (N = 51,874 male and female employees in Finland)



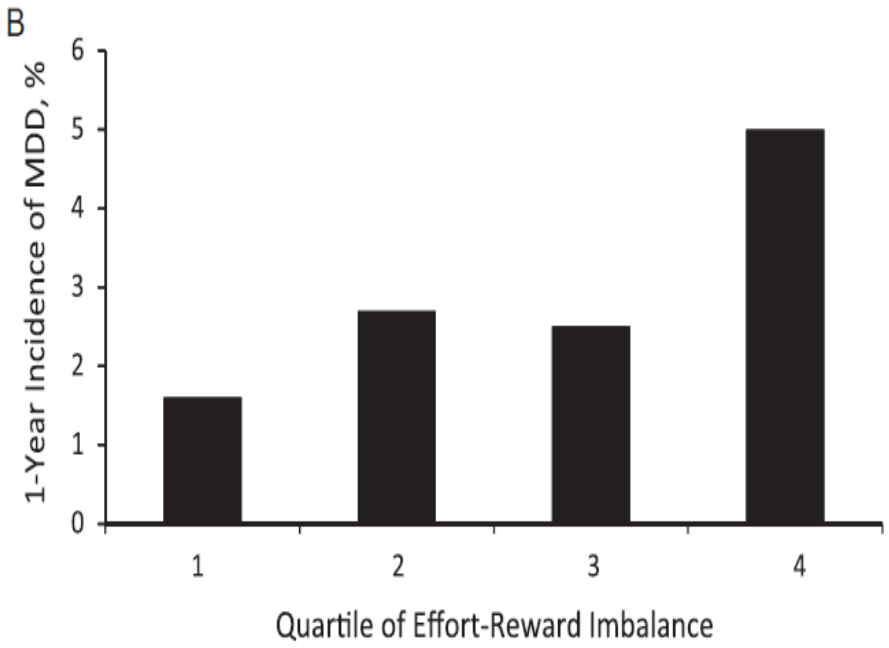
Source: Juvani A et al. (2014) *Scand J Work Environ Health* 40:266-77

Gender and association of work stress (ERI) with depression

1-year incidence of severe depression; n = 2752 Canada)



Men



Women

Source: Wang J (2012) Am J Epidemiol 176: 52-59

Work stress and depression in a developing country
(ELSA-Brasil study; N = 10,034)

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Prevalence ratio (PR) of depression (highest vs. lowest quartile of ERI) scales: Poisson Regressions analyse

Scale	PR 1. Quartile	PR 4. Quartile	95% CI
Effort (E)	**1.00**	**1.85**	1.44 - 2.37
Reward (R)	**1.00**	**3.44**	2.55 - 4.64
Over-commitment	**1.00**	**3.62**	2.80 - 4.70
Ratio E/R	**1.00**	**2.47**	1.92 - 3.17

Source: de Araujo TM et al. (2019) *Int J Environ Res Public Health 16*, 3025

Prospective epidemiological evidence: Effort-reward imbalance and risk of depression

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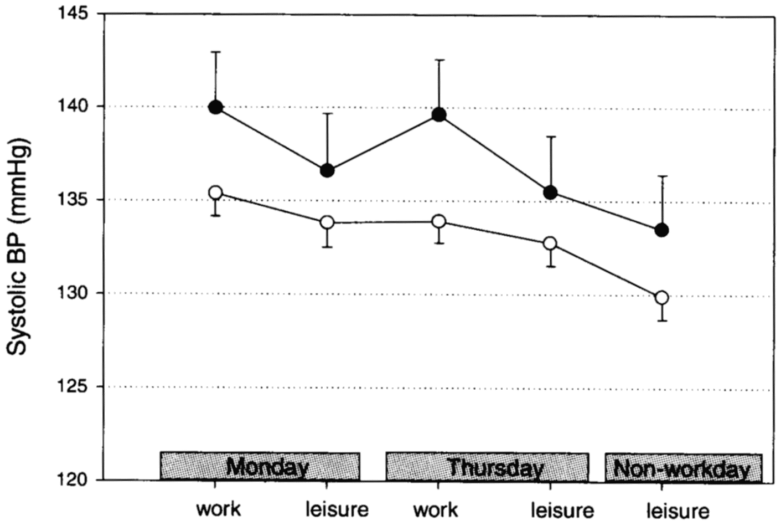
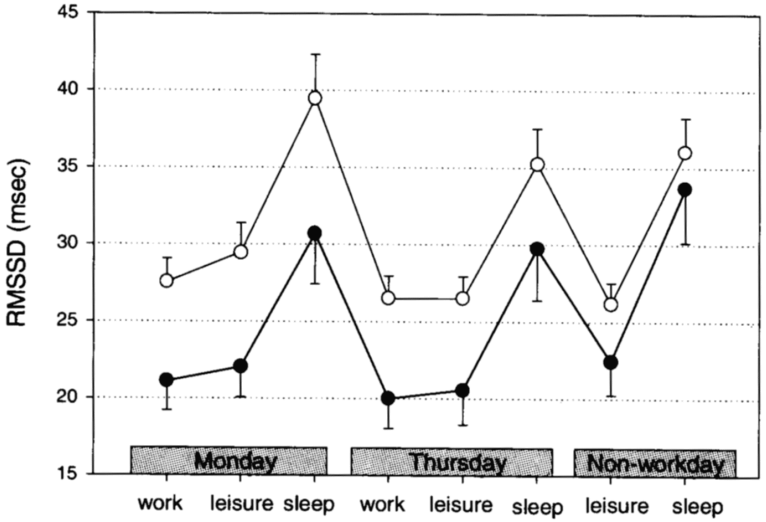
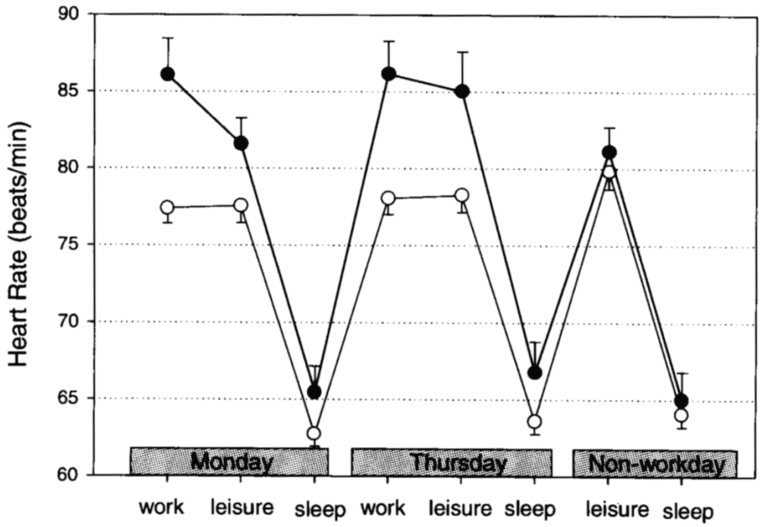
Reference (year)	Relative risk, Odds ratio (95 % CI)
Stansfeld (1999)	2.57 (1.82; 3.63) (m) 1.67 (1.00; 2.80) (w)
Godin (2004)	4.6 (2.3; 9.2) (m) 3.2 (1.6; 6.4) (w).
Kivimäki (2007)	1.49 (1.22; 1.81)
Siegrist (2012)	1.51 (1.28; 1.78)
Wang (2012)	2.32 (1.14; 4.73)
Rugulies (2013)	2.19 (1.12; 4.25)
Juvani (2014)	1.90 (1.51; 2.40)
Wege (2018)	1.82 (1.36; 2.44) (m) 1.88 (1.51; 2.33) (w)
Nigatu (2018)	1.56 (1.25; 1.96)
Matthews (2022)	1.29 (1.01; 1.60)
Pena-Gralle (2023)	1.73 (1.41; 2.12)

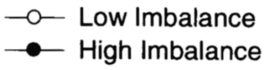
3. Quasi-experimental and naturalistic studies

ERI and ambulatory cv parameters (3 days; N=109 men)





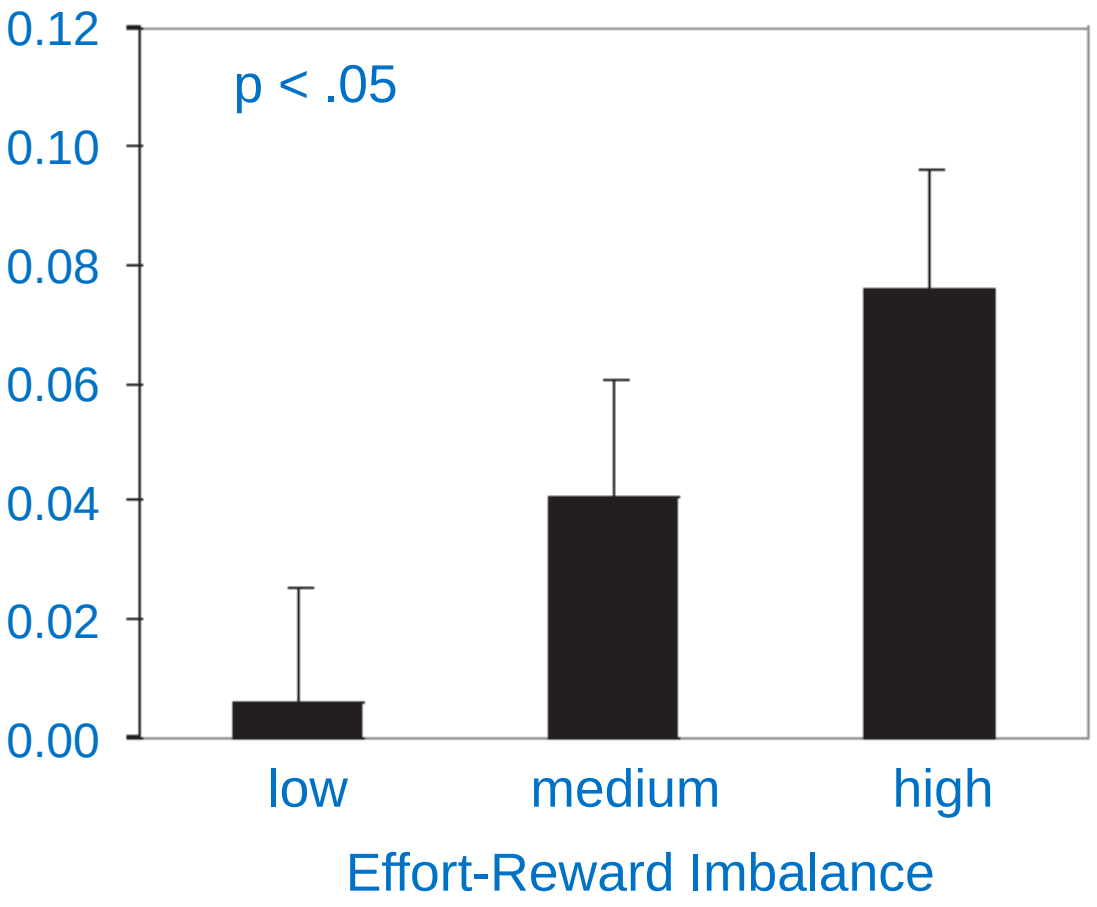




Source: Vrijkotte et al. (2000), *Hypertension*, 35: 880.

Inflammatory response (CRP) to experimental mental stress according to level of ERI (N=92)

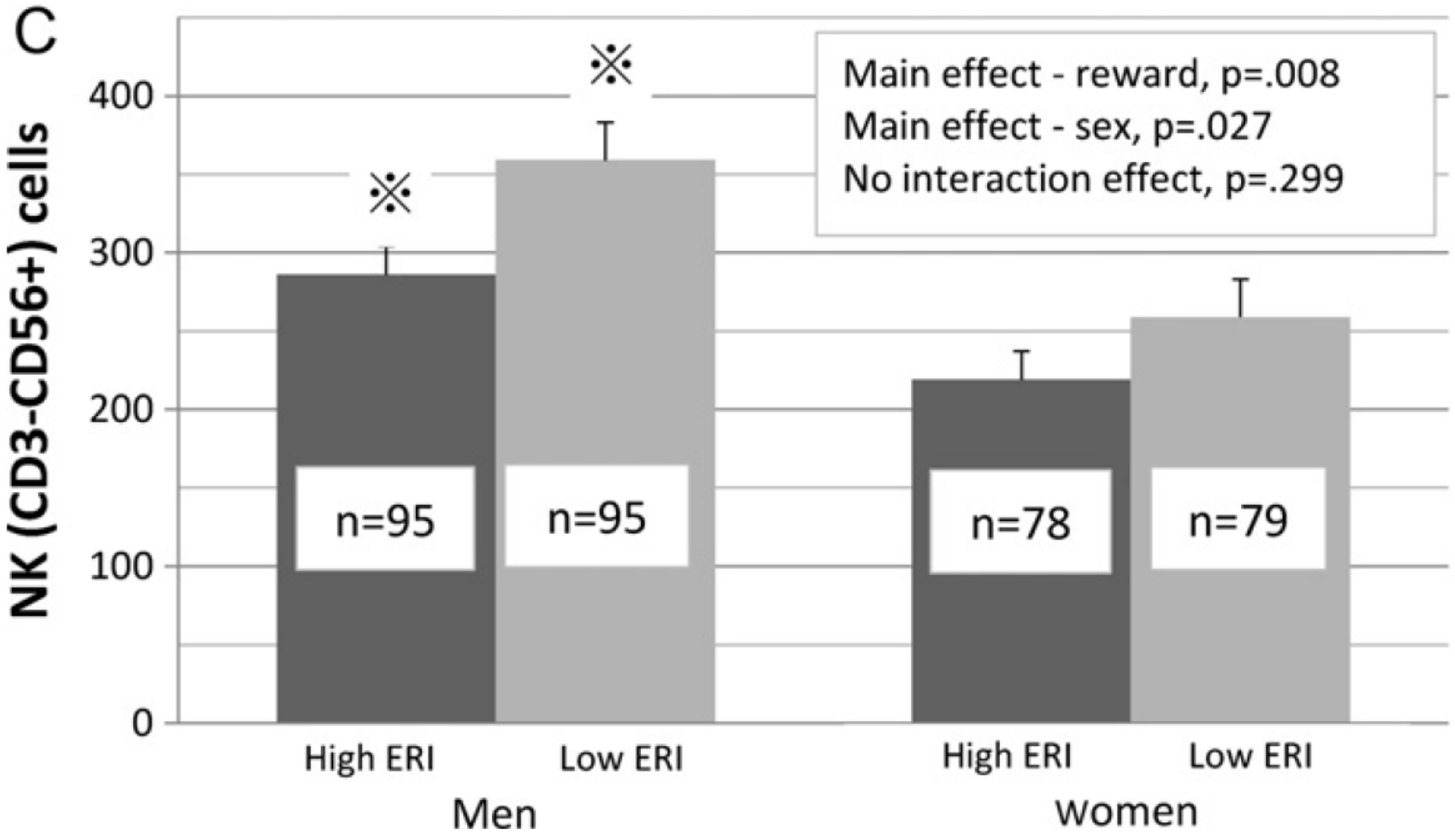
CRP change* (µg/ml) as function of effort-reward imbalance



* adjusted for age, BMI, baseline levels

Source: Based on Hamer M et al. (2006) Psychosom Med 68: 408-413

Work stress (ERI) and natural killer cells



347 Japanese employees

Source: Nakata A et al (2011), Biol Psychol 88:270-279, (p. 277).

4. Intervention studies

Intervention measures related to the ERI model can be applied at three levels:

Personal/ interpersonal level:

- Reduced over-commitment; leadership training to increase esteem and commitment

  Li J. et al. (2017) *Psychotherapy & Psychosomatics* 86, 113-115

Structural-organisational level:

- Measures to reduce effort and to increase reward

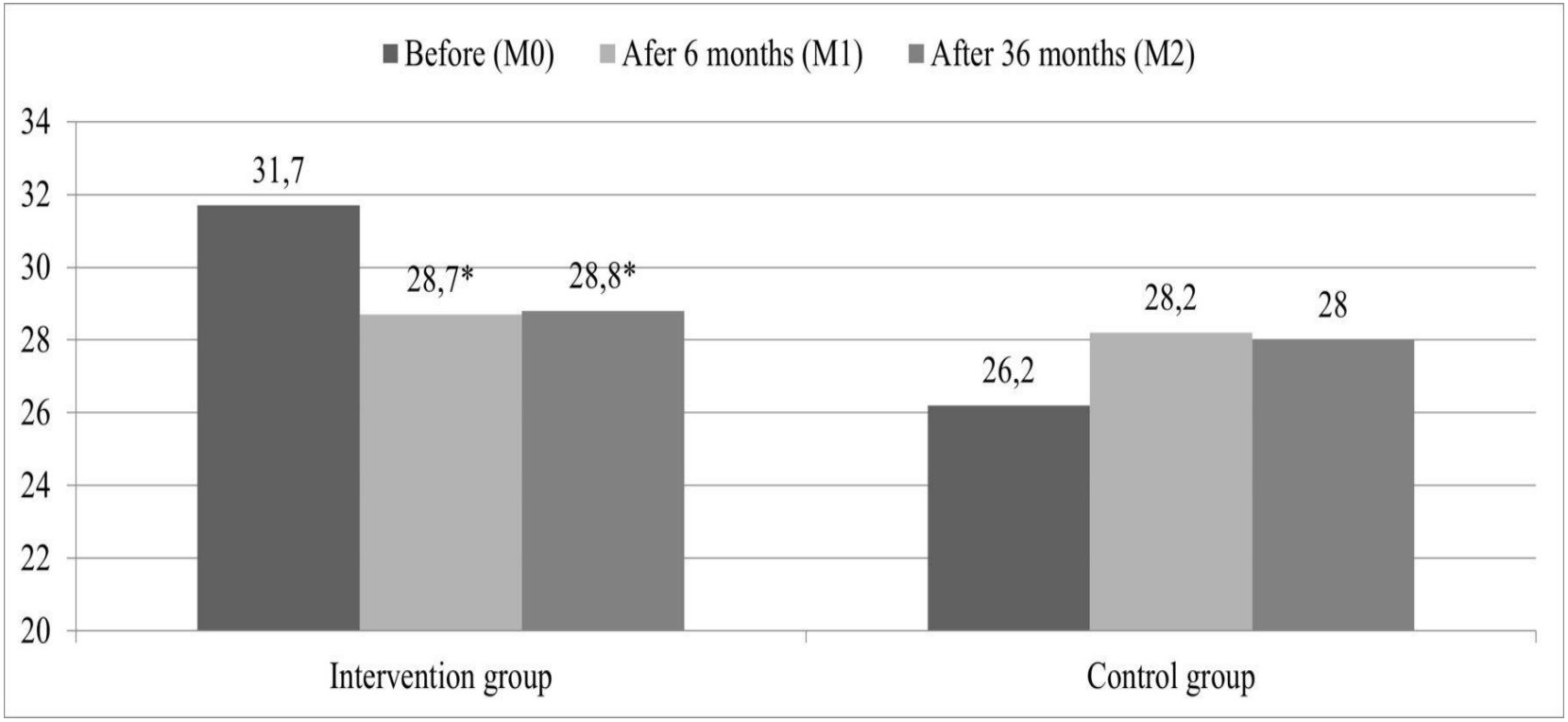
  Trudel X et al. (2021) *Occup Environ Med* 78(10): 738-744

National policy- related level:

- Active labour market policies at national level (e.g. LM integration policies, lifelong- learning)

  : Lunau T. et al. (2015) *PLoS One* 10(3) e0121573

Prevalence of hypertension in an intervention group (N=1088) and control group (N=1068) in Canada



Organisational change based on job strain and ERI models;
Three times: baseline (M0); 6m (M1); 36m (M2)
Prevalence ratio IG vs. CG: 0.85 (0.74; 0.98)

Source: Trudel X et al. (2021) *Occup Environ Med 78*(10): 738-744.

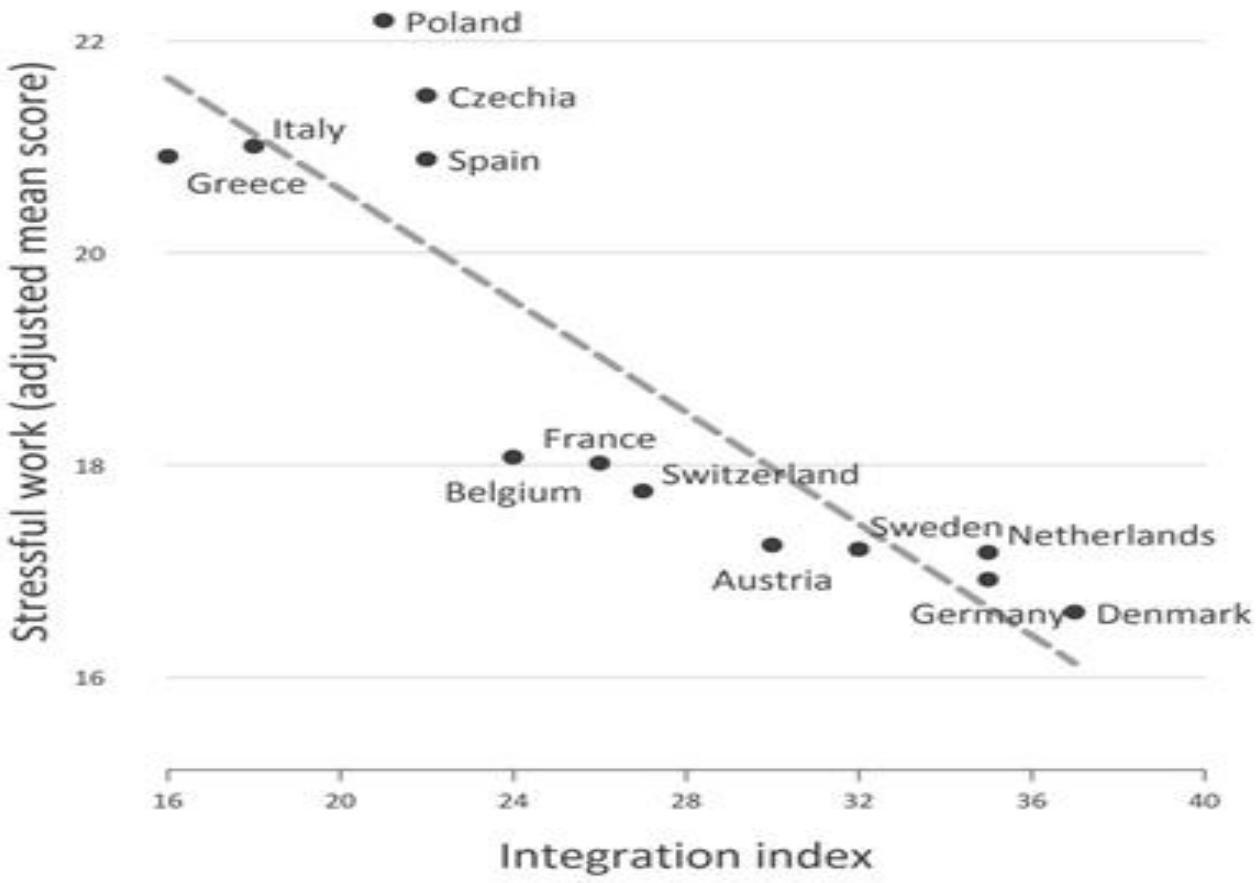
Prevention at the macro- (political) level

Implementing national labour market integration policies

Example:

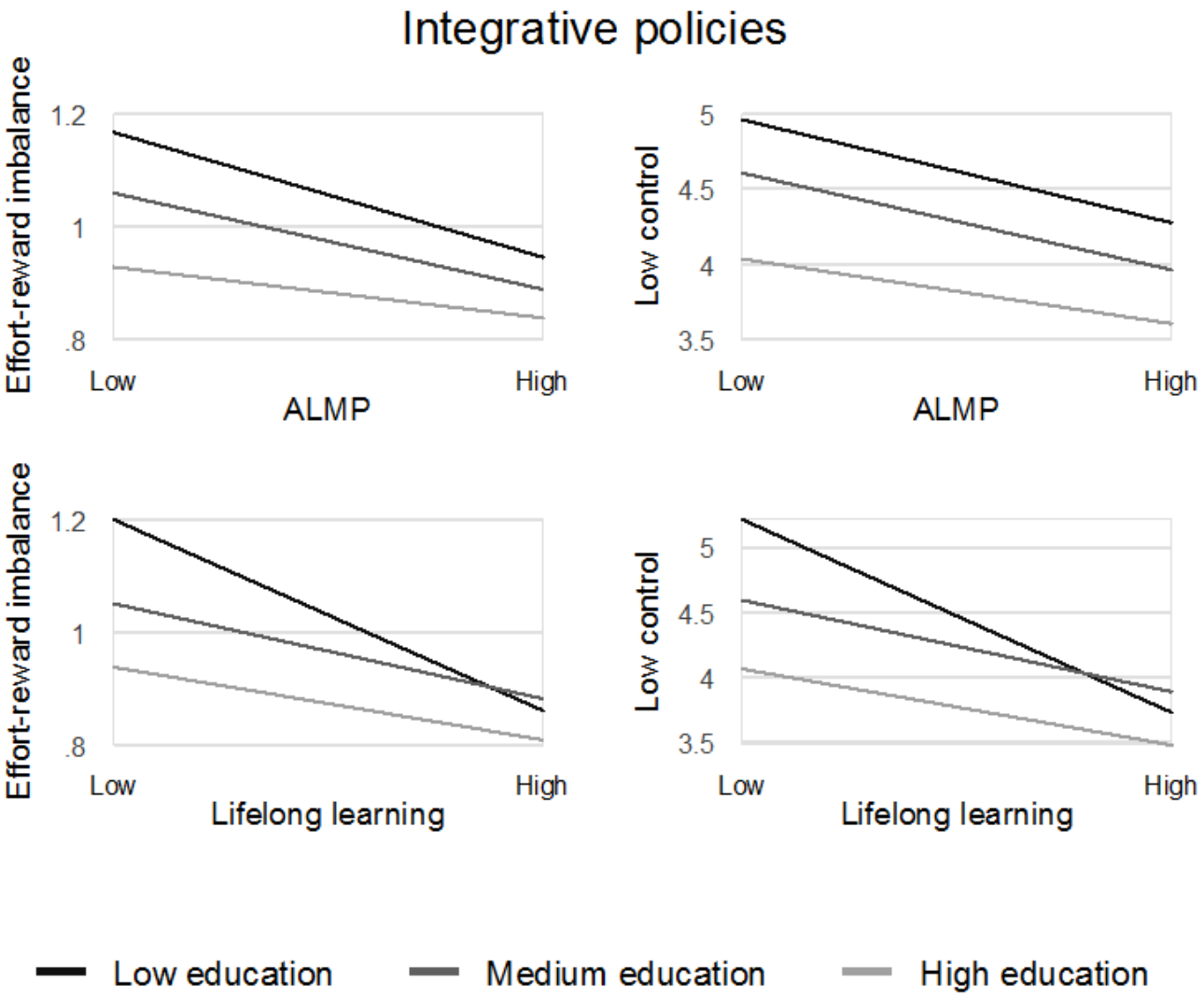
Reduced work stress in countries with strong integration policies (OECD- Index; SHARE data)

N= 13 European countries



Source: Wahrendorf M, Siegrist J (2014) BMC Public Health 14:849

Social gradients of work stress (ERI, low control) vary according to extent of implemented LMPs in 16 European countries (SHARE; N = 13,695)



Source: Lunau T. et al. (2015) PLoS One 10(3) e0121573

Some science- and policy-related challenges (I)

- Theoretical models conceptualized at the meso-social level of organisations are no longer appropriate in times of economic globalisation and of digitized and AI-determined working and employment conditions.

- At least, they need to be integrated into macrostructurally- based multi-level models addressing the transnational economic and political determinants.

- Simplistic notions of exposure (e.g. one measure reflecting current state at baseline) are no longer adequate. They need to be transformed into trajectory-oriented, dynamic patterns, taking flexibility, disruption, and cumulative effects into account.

Some science- and policy-related challenges (II)

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- Paid work will remain a core element of a society's social structure, and a significant goal of shaping the lifecourse. However, traditional boundaries to organisations, support systems, and associations, including trade unions, are weakened and are fading away.

- Under these conditions, legal regulations and labour / welfare policies at national and transnational level need to be developed, maintained, and strengthened.

- Strong scientific evidence on the burden of work-related disease is important, but insufficient to significantly advance healthy work in a global perspective.

- To this end, the communities of occupational scientists, professionals, and stakeholders are called to collaborate in joint activities to build a sustainable future.

Many thanks!