



Work stress and CVD risk: reasons for, and evidence of interventions

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INTRODUCTION: Background and aims



- Cardiovascular diseases (CVD), and specifically ischaemic heart disease (IHD) and stroke, are major contributors to the global burden of disease.
- Among important modifiable CVD risk factors distinct stressful working conditions were identified, based on epidemiologic cohort studies.
- In addition to shift work and long working hours, these conditions include adverse psychosocial work environments, as defined by theoretical models.
- Two such models, demand-control and effort-reward imbalance, provide particularly strong evidence with regard to IHD, but complementary models (e.g. organisational injustice, job insecurity) are emerging as well.
- In this presentation, this evidence is briefly reviewed, and its implications for designing, implementing, and evaluating interventions (theory-based worksite prevention programs) are discussed.

INTRODUCTION: Theoretical models



➤ Demand-control model:

Jobs defined by **high psychological demand** and **low control** (decision authority and skill discretion) evoke negative emotions and cognitions (frustration, monotony, lack of self efficacy).

Jointly, they activate **psychobiological stress reactions** (arousal of SAM and HPA axes). (,high strain').

These effects are **amplified** by lack of **social support** at work (,isostrain'), and **moderated** by presence of strong support at work.

➤ Effort-reward imbalance model:

Employment conditions involving **high effort** in combination with **low reward** (money, status control, appreciation) evoke negative emotions and cognitions (anger, disappointment, unfairness, low self-esteem).

Jointly, they activate cortico-limbic reward structures with arousal of **psychobiological stress axes**.

These effects are **amplified** by a distinct personal characteristic of coping with demands (,over-commitment').

INTRODUCTION: Assessment

Both models are mainly measured by **psychometrically validated scales** with Likert-scaled items, collecting self-reported information:

- **Job Content Questionnaire (JCQ):**
Demand 5, Control 9, Support 8 items (Karasek et al. 1998)
- **Effort-Reward Imbalance Questionnaire (ERI):**
Effort 5, Reward 11, Over-commitment 6 items (Siegrist et al. 2004)

An **alternative assessment** is based on **Job Exposure Matrix (JEM)**:

- **Mean scores** of these scales derived from representative surveys are **computed for each job title** as classified e.g. by ISCO-88.
- JEM offers a **standardized**, yet crude **exposure measure**, independent of subjective information.
- There is **limited** prospective **evidence** for the two models based on JEM (Niedhammer et al. 2000; Faruque et al. 2022)

- Prospective observational cohort studies provide the data base for causal inference in epidemiology (Hill criteria of causal associations).
- To this end, work stress models (or proxies) are assessed at baseline, and incident CVD/IHD events are related to exposure (OR, RR, HR with 95% CI), using multivariable regression analysis with control of confounders.
- Results of single or combined cohort studies are synthesized in systematic reviews, with meta-analyses providing pooled risk estimates.
- Number of independent replications and strength of associations are relevant criteria of quality of evidence.

RESULTS: Systematic reviews (up to 20 studies)



Pooled risk estimates of IHD or mortality according to different psychosocial exposures at work, based on systematic reviews (SR) and individual studies (IS)

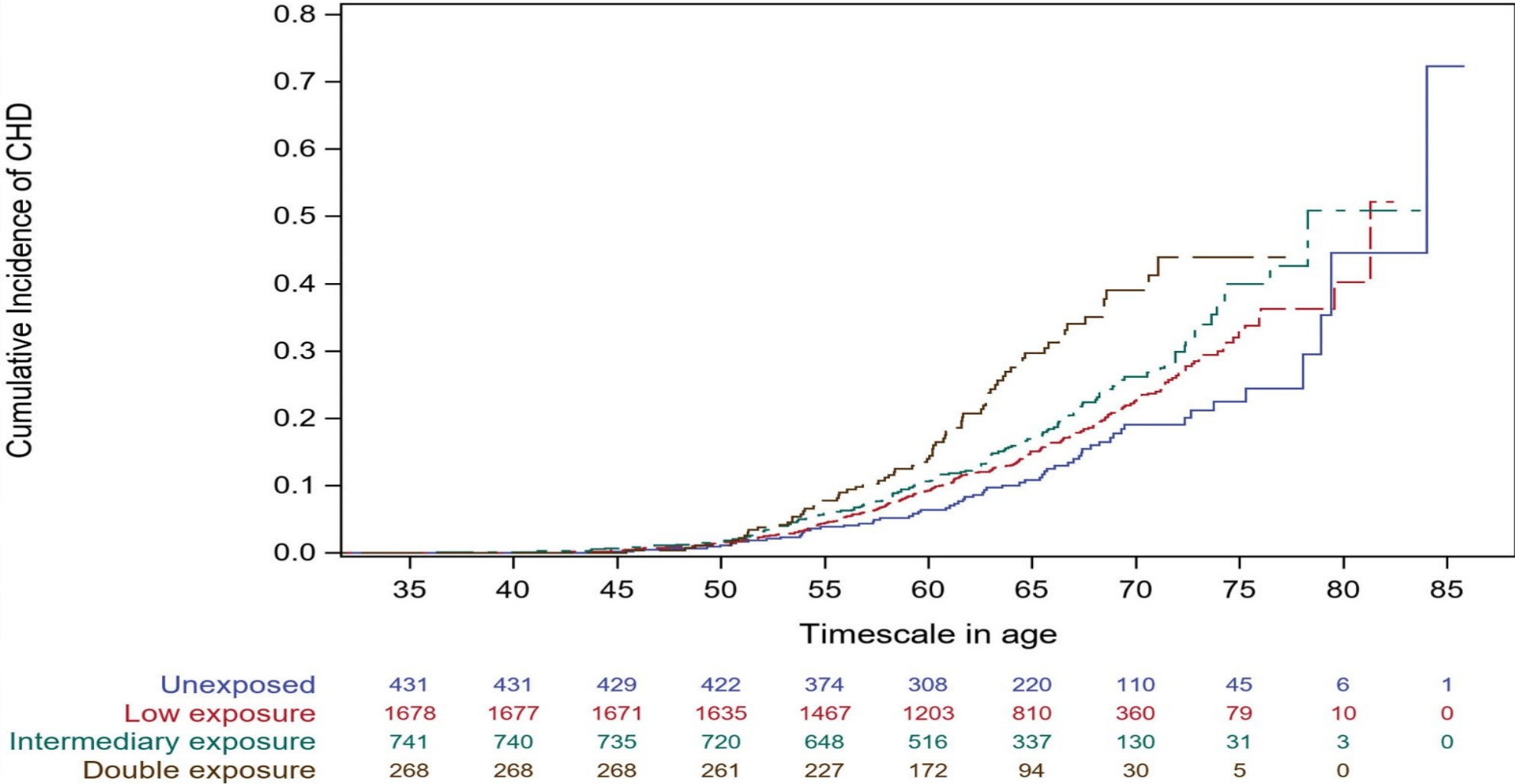
First author (year)	Study type	Exposure	Health outcome	RR (95% CI)
Kivimäki et al., (2012)	SR	Job strain	Incident IHD	1.23 (1.10; 1.37)
Dragano et al., (2017)	SR	Effort-reward	Incident IHD	1.16 (1.00; 1.35)
Dragano et al., (2017)	SR	Job strain + Effort reward	Incident IHD	1.41 (1.12; 1.76)
Niedhammer et al., (2021)	SR	Job insecurity	Incident IHD	1.32 (1.09; 1.59)
Li et al., (2015)	SR	Job strain + Effort reward	Recurrent IHD	1.65 (1.23; 2.22)
Trudel et al., (2021)	IS	Job strain + LWH	Recurrent IHD	2.55 (1.30; 4.98)
Kivimäki et al., (2018)	IS	Job strain (with CMD)	Mortality (men)	1.68 (1.19; 2.35)
Kivimäki et al., (2018)	IS	Effort reward (without CMD)	Mortality (men)	1.22 (1.06; 1.41)
Niedhammer et al. (2021)	SR	Organisational justice	Cardiovascular mortality	1.62 (1.24; 2.13)

CMD = cardiometabolic disease; LWH = long working hours; RR = relative risk

RESULTS: Double exposure DC and ERI (Lavigne-Robichaud et al. 2023)



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



RESULTS: Pooled estimates of additional CVD risks

Ischemic stroke

- DC model
 - Review 1 (13 studies) RR: 1.18 (1.00, 1.39) (Fransson et al. 2015)
 - Review 2 (3 studies) RR: 1.38 (1.12, 2.23) (Huang et al. 2015)

Type -2 diabetes

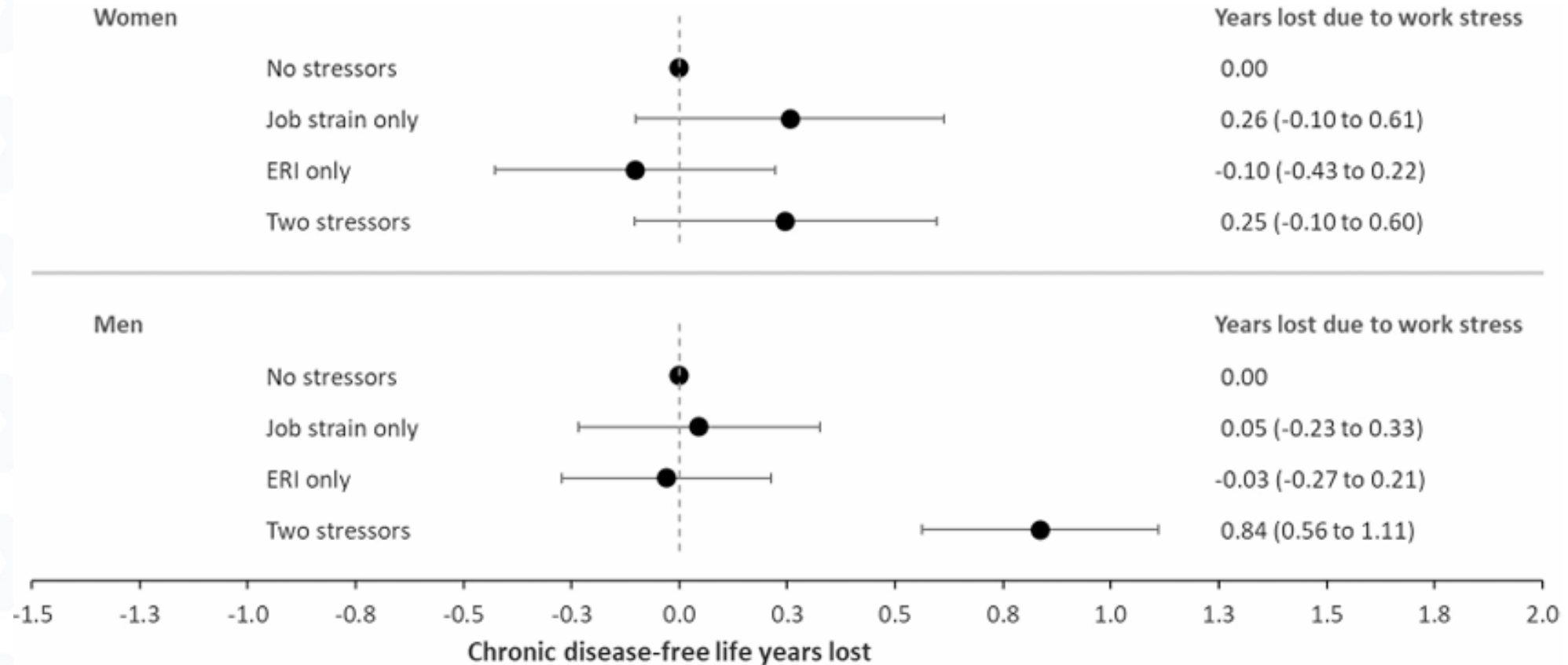
- DC model (15 studies) RR: 1.06 (1.07, 1.26) (Pena-Gralle et al. 2022)
- ERI model (6 studies) RR: 1.24 (1.08, 1.42) (Pena-Gralle et al. 2022)

Hypertension

- DC model (7 of 19 studies*) OR ranging from 1.1 to 3.4 (Gilbert-Ouimet et al. 2014)
- ERI model (5/6 studies*) OR ranging from 1.6 to 2.7 (Gilbert-Ouimet et al. 2014)

* Prospective, cross-sectional or case-control studies

RESULTS: Significance of joint effects (DC and ERI)



Work stress (DC and ERI) and incident chronic disease (incl.CVD) in 1.59 mio. Danish employees followed over 18 years (Soerensen et al. 2022)

RESULTS: Summary

- An **adverse psychosocial work environment**, as defined by DC and ERI, represents **a new, modifiable determinant of CVD**, and specifically of IHD.
- The **strength of associations** with each single work-related stressor is limited, but is clearly **enhanced by combined exposure** of DC and ERI (with RR up to 2.0).
- Evidence derived from **cohort studies** is supplemented by associations of stressful work with **main CV risk factors** (e.g. hypertension, type 2 diabetes) and with **biomarkers** underlying these associations (e.g. ANS, endocrine, immune, inflammatory activity).
- In view of the **high prevalence of exposure** (up to 25 % of employed populations) and the work-related **burden of CVD** measures of **intervention** are required.
- To this end, programs of **primary prevention in occupational settings** deserve high priority.

RESULTS: Implications for intervention: Three levels

Worksite stress prevention programs can be performed at three levels:

Personal level:

- Stress prevention; relaxation; biofeedback; resilience; coping skills training

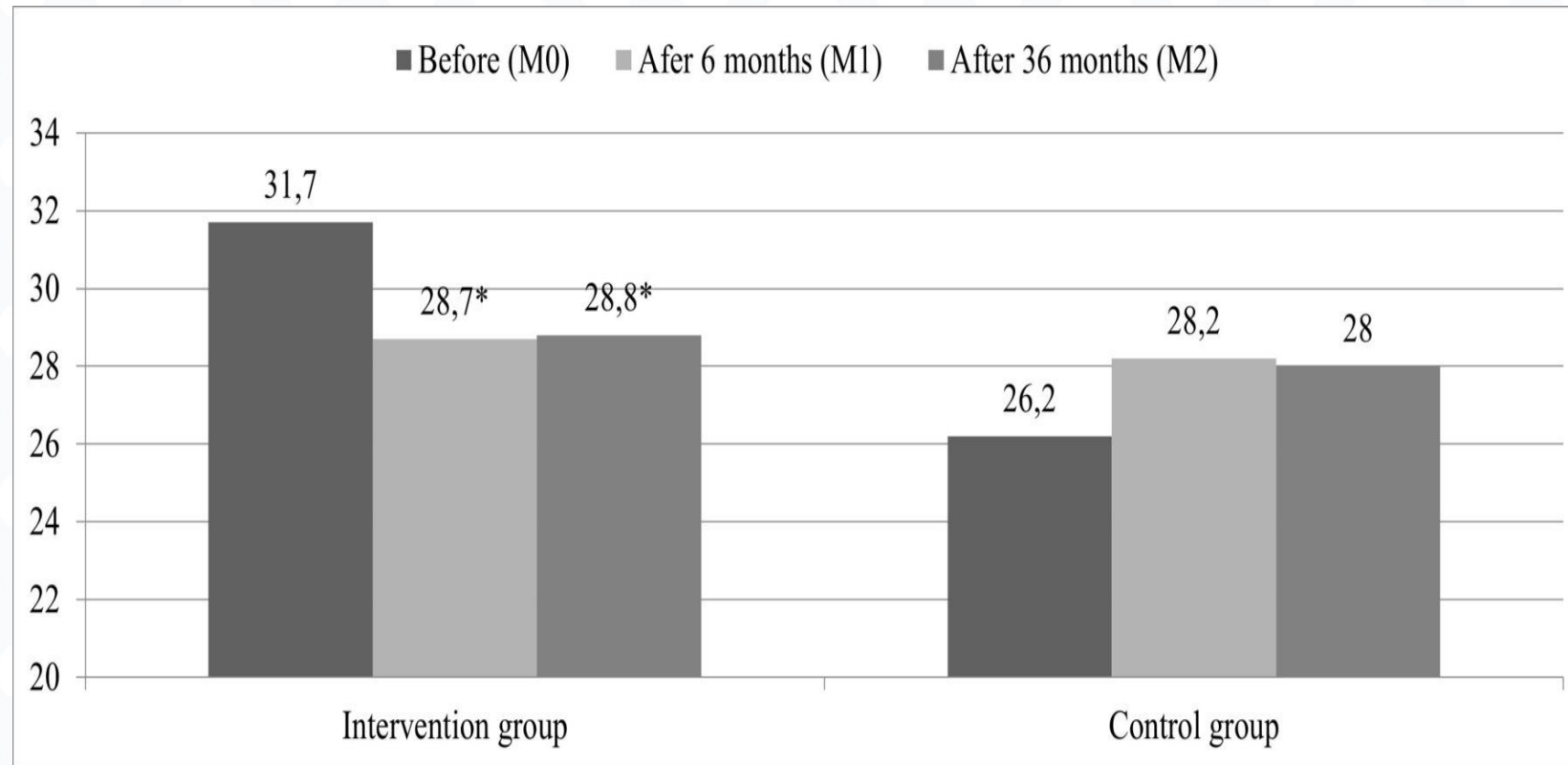
Interpersonal level:

- Leadership training; improved communication; team work; appreciation; participatory intervention; strengthening empathy and socioemotional skills

Structural level:

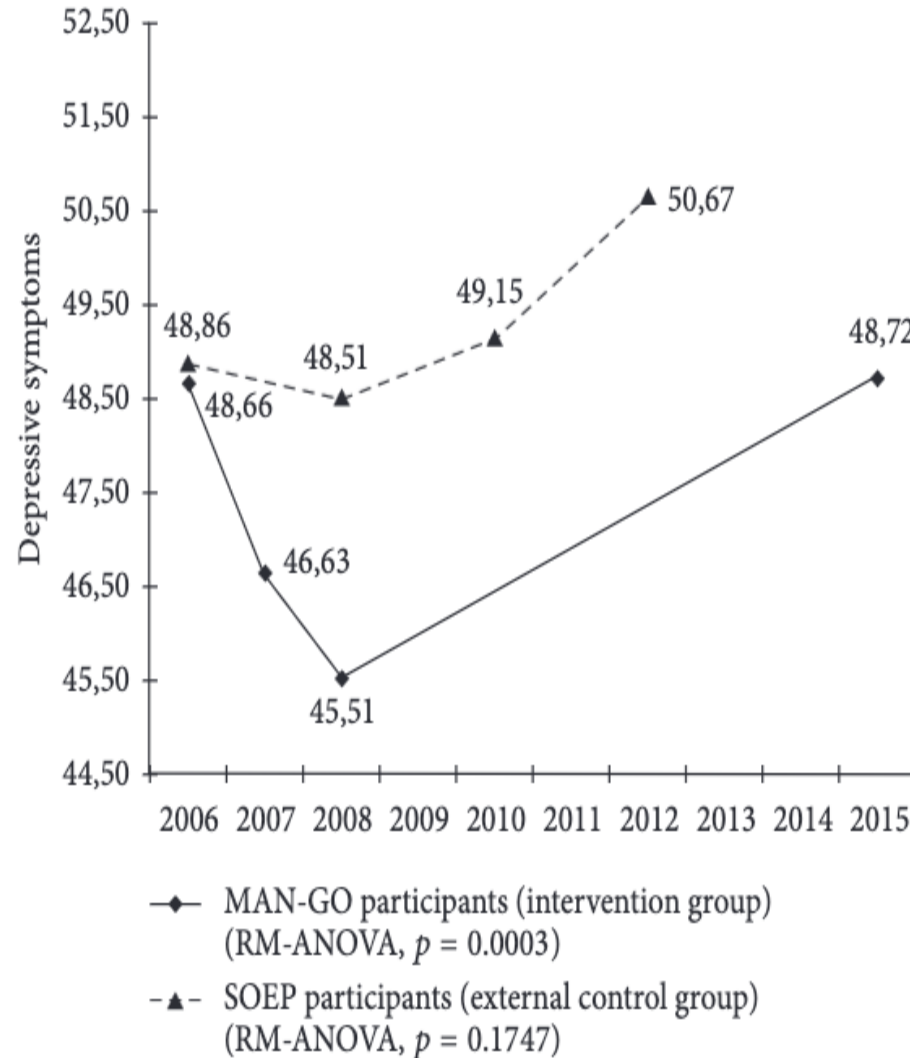
- Organizational/personnel development; work schedules, job enrichment, autonomy, fair pay; promotion prospects; training opportunities; work-family-friendly policies; options of recreation; organisational justice and safety climate; job change and return-to work programs

RESULTS: Implications for intervention: A Quebec study



Prevalence of hypertension in an intervention group (N=1088) and control group (N=1068) in Canada: **Organisational change based on DC 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) OEM 78(10), 738)

RESULTS: Implications for intervention: Stress prevention



Levels of depressive symptoms in an intervention group (N=94) and external control group (N=94) in Germany: **Individual stress management based on ERI model;**

Three times: pre-intervention (2006); post-intervention (2008); post-trial follow-up (2015)

(Source: Li J, et al. (2017) Biomed Research International 2853813)

DISCUSSION AND CONCLUSION



Despite considerable scientific progress there is **restricted knowledge** on successful and **sustainable** approaches to **primary prevention** in occupational life.

This **gap of knowledge** can be filled by closer **collaboration** of researchers with occupational health professionals and personnel managers in businesses and companies.

However, **new challenges** induced by expansion of homework, increased mobility, de-standardized employment arrangements and intense competition need to be **tackled**.

Joint efforts across disciplinary boundaries and across different claims of interest are required to **advance** the expansion of **healthy work**.

➤ **“Do something, do more, do better!”** (M. Marmot 2012)

References on psychosocial work-related stress and CVD/IHD risk:

- Lavigne-Robichaud M, Trudel X, Talbot D et al. (2023) Circ Cardiovasc Qual Outcomes 16, e009700
- Siegrist J, Li J (2024) Psychosocial occupational health. Oxford: Oxford University Press
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References on intervention studies:

- Li J, Riedel N, Barrach A et al. (2017) Biomed Research International 2853813
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