Psychosocial work factors and blood pressure among 63,800 employees from the Netherlands in the Lifelines cohort study

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Supplementary data

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Appendix 1: Construction of effort-reward imbalance (ERI) and emotional demands JEMs.

ERI and emotional demands were measured with JEMs based on information from the Danish Work Environment Cohort Study (DWECS). ERI was measured by combining four items on effort and four items on reward, and emotional demands were calculated as the mean score of three DWECS items on emotional demands (details of these items are given in supplementary tables 1&2). Since DWECS did not incorporate the original ERI questionnaire described by Siegrist et al,[1] ERI was assessed with proxy measures. Details of ERI construction are given elsewhere.[2,3] For calculating effort, four items from the Copenhagen Psychosocial Questionnaire were used. Each item had five response categories (Supplementary Table 1). On the other hand, seven items were used in calculating reward score. Both effort and reward scores were resulted from summing up the numeric values of the items in a way that a higher score indicates a higher effort or reward. ERI ratio was calculated placing reward in the denominator and effort in the nominator. Thus a s high score indicates a higher effort-reward imbalance. The JEMs were constructed in DWECS as the predicted probability of ERI and the predicted level of emotional demands given job group, sex, age, and year of data collection (2000, 2005). The job group was coded according to the four-digit level of DISCO-88, the Danish version of the International Standard Classification of Occupations (ISCO)-88 system. A higher score indicates higher ERI or higher emotional demands.

References:

1. Kristensen TS, Hannerz H, Høgh A, et al. The Copenhagen Psychosocial Questionnaire--a tool for the assessment and improvement of the psychosocial work environment. Scand J Work Environ Health 2005;31(6):438-49.

2. Rugulies R, Aust B, Siegrist J, et al. Distribution of effort-reward imbalance in Denmark and its prospective association with a decline in self-rated health. J Occup Environ Med 2009;51(8):870-8

3. Rugulies R, Aust B, Madsen IE, et al. Adverse psychosocial working conditions and risk of severe depressive symptoms. Do effects differ by occupational grade? Eur J Public Health 2013;23(3):415-20.

Supplementary Table 1: Items and response options for the effort-reward imbalance job-exposure matrix, including dichotomization of items

	Items	Response options	Dichotomization
Effort	How often do you not have time to complete all your work tasks?	1: Never/hardly ever; 2: Seldom; 3: Sometimes; 4: Often; 5: Always	1: Never/hardly ever, Seldom, Sometimes 2: Often, Always
	Is your workload unevenly distributed so it piles up?	1: Never/hardly ever; 2: Seldom; 3: Sometimes; 4: Often; 5: Always	1: Never/hardly ever, Seldom, Sometimes 2: Often, Always
	Do you have to work overtime?	1: Never/hardly ever; 2: Seldom; 3: Sometimes; 4: Often; 5: Always	1: Never/hardly ever, Seldom, Sometimes 2: Often, Always
	Do you have to work very fast?	1: Never/hardly ever; 2: Seldom; 3: Sometimes; 4: Often; 5: Always	1: Never/hardly ever, Seldom, Sometimes 2: Often, Always
Reward	Is your work recognized and appreciated by management?	1: To a very small extent; 2: To a small extent; 3: Somewhat; 4: To a large extent; 5: To a very large extent	1: To a very small extent, To a small extent, Somewhat 2: To a large extent, To a very large extent
	Have you good prospects for the future in your job?	1: To a very small extent; 2: To a small extent; 3: Somewhat; 4: To a large extent; 5: To a very large extent	1: To a very small extent, To a small extent, Somewhat 2: To a large extent, To a very large extent
	Are you worried about being transferred to another job against your will?	1: Yes, 2: No	1: Yes, 2: No
	Are you worried about becoming unemployed?	1: Yes, 2: No	1: Yes, 2: No

Supplementary Table 2: Items and response options for the emotional demands job-exposure matrix.

Emotional demands scale	Items	Response options
	Does your work put you in emotionally disturbing situations?	Always; Often; Sometimes; Seldom; Never/hardly ever
	Is your work emotionally demanding?	To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent
	Do you get emotionally involved in your work?	To a very large extent; To a large extent; Somewhat; To a small extent; To a very small extent

Supplementary Table 3: Association between psychosocial work factors and blood pressure.

Psychosocial work factors	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)		Hypertension	
	B (95%CI)	p	B (95%CI)	p	OR (95%CI)	p
Job strain						
Unadjusted	**1.52 (0.59;2.46)**	**<0.01**	-0.05 (-0.66;0.55)	0.86	**1.30 (1.10;1.53)**	**<0.01**
Adjusted	**2.14 (1.23;3.06)**	**<0.01**	**1.26 (0.65;1.86)**	**<0.01**	**1.43 (1.17;1.74)**	**<0.01**
Co-exposure	**1.31 (0.34;2.28)**	**<0.01**	**1.13 (0.49;1.77)**	**<0.01**	**1.32 (1.07;1.63)**	**<0.01**
ERI						
Unadjusted	**16.31 (14.20;18.42)**	**<0.01**	**16.67 (15.31;18.03)**	**<0.01**	**12.15 (8.56;17.26)**	**<0.01**
Adjusted	-0.61 (-2.60;1.38)	0.55	**4.37 (3.05;5.68)**	**<0.01**	1.09 (0.73-1.62)	0.67
Co-exposure	-1.14 (-3.15;0.88)	0.27	**4.01 (2.67;5.34)**	**<0.01**	1.01 (0.67;1.51)	0.97
Emotional demands						
Unadjusted	**-3.85 (-4.07;-3.63)**	**<0.01**	**-1.11 (-1.25;-0.96)**	**<0.01**	**0.78 (0.75;0.82)**	**<0.01**
Adjusted	**-0.90 (-1.14;-0.66)**	**<0.01**	0.01 (-0.15;0.17)	0.86	**0.91 (0.87-0.96)**	**<0.01**
Co-exposure	**-0.79 (-1.05;-0.54)**	**<0.01**	0.11 (-0.05;0.28)	0.18	**0.93 (0.88;0.99)**	**0.02**

B = Coefficients of the regression analyses; OR= Odds ratio; ERI = Effort-reward imbalance; CI = Confidence interval;
Linear regression models adjusted for age, sex, BMI, education, monthly income, pack-years, smoking, alcohol consumption, and antihypertensive medication were used to investigate the association between psychosocial work factors and blood pressure.
Logistic regression models adjusted for the covariates (except antihypertensive medication) were used to investigate the association between psychosocial work factors and hypertension.
In the co-exposure analyses, regression models were adjusted for covariates and psychosocial work factors.

Supplementary Table 4: Association between psychosocial work factors and blood pressure in subjects without antihypertensive medication.

Psychosocial work factors	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)		Hypertension	
	B (95%CI)	p	B (95%CI)	p	OR (95%CI)	p
Job strain	**1.77 (0.84;2.69)**	**<0.01**	**0.92 (0.31;1.54)**	**<0.01**	**1.32 (1.04;1.66)**	**0.02**
ERI	-1.08 (-3.13;0.96)	0.30	**3.93 (2.58;5.29)**	**<0.01**	0.93 (0.58;1.48)	0.75
Emotional demands	**-0.87 (-1.12;-0.62)**	**<0.01**	-0.02 (-0.18;0.14)	0.80	**0.88 (0.82;0.93)**	**<0.01**

B = Coefficients of the regression analyses; OR= Odds ratio; CI = Confidence interval; ERI = Effort-reward imbalance. Models were adjusted for sex, BMI, education, monthly income, pack-years, smoking, and alcohol consumption.

Supplementary Table 5: Association between job strain and blood pressure (co-exposure model).

Occupational groups	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)		Hypertension	
	B (CI95%)	p-value	B (CI95%)	p-value	OR (CI95%)	p-value
Group 1 (n = 2,752)	-1.0 (-6.5;4.4)	0.706	1.0 (-2.7;4.7)	0.594	**0.7 (0.5;1.0)**	**0.032**
Group 2 (n = 15,124)	**-6.2 (-9.4;-3.0)**	**<0.001**	-1.1 (-3.3;1.0)	0.295	0.9 (0.8;1.2)	0.607
Group 3 (n = 13,294)	0.9 (-0.8;2.7)	0.283	1.1 (0;2.3)	0.055	1.1 (1.0;1.2)	0.083
Group 4 (n = 7,020)	-9.7 (-20.1;0.7)	0.067	**12.4 (5.6;19.2)**	**<0.001**	1.2 (0.5;3.3)	0.657
Group 5 (n = 11,295)	**6.3 (3.2;9.5)**	**<0.001**	0.8 (-1.2;2.9)	0.426	1.1 (0.9;1.2)	0.297
Group 6 (n = 1,903)	-13.7 (-36.6;9.2)	0.241	-1.9 (-16.8;12.9)	0.797	1.0 (0.7;1.4)	0.830
Group 7 (n = 5,166)	**4.1 (0.3;7.9)**	**0.036**	1.7 (-0.9;4.3)	0.196	**1.2 (1.0;1.4)**	**0.040**
Group 8 (n = 2,612)	0 (-6.1;6.2)	0.991	**7.4 (3.2;11.6)**	**0.001**	1.1 (0.8;1.4)	0.752
Group 9 (n = 4,372)	-3.1 (-8.6;2.5)	0.282	-1.2 (-4.8;2.4)	0.520	0.9 (0.7;1.2)	0.698

B = Coefficients of the regression analyses; OR= Odds ratio; ERI = Effort-reward imbalance; CI = Confidence interval;
Linear regression models adjusted for age, sex, BMI, education, monthly income, pack-years, smoking, alcohol consumption, and antihypertensive medication were used to investigate the association between psychosocial work factors and blood pressure.
Logistic regression models adjusted for the covariates (except antihypertensive medication) were used to investigate the association between psychosocial work factors and hypertension.
In the co-exposure analyses, regression models were adjusted for covariates and psychosocial work factors.
Group 1 = Legislators, senior officials, and managers; Group 2 = Professionals ; Group 3 = Technicians and associate professionals; Group 4 = Clerks; Group 5 = Service workers and shop and market sales workers; Group 6 = Skilled agriculture and fishery workers ; Group 7 = Craft and related trades workers; Group 8 = Plant and machine operators and assemblers; Group 9 = Elementary occupations

Supplementary Table 6: Association between ERI and blood pressure (co-exposure model).

Occupational groups	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)		Hypertension	
	B (CI95%)	p-value	B (CI95%)	p-value	OR (CI95%)	p-value
Group 1 (n = 2,752)	6.0 (-4.9;16.8)	0.280	3.3 (-4.0;10.7)	0.376	1.2 (0.9;1.6)	0.144
Group 2 (n = 15,124)	-1.0 (-5.1;3.2)	0.646	**4.8 (2.0;7.6)**	**0.001**	1.0 (0.9;1.1)	0.876
Group 3 (n = 13,294)	-1.2 (-5.3;2.9)	0.559	1.8 (-0.9;4.5)	0.186	1.0 (0.9;1.1)	0.770
Group 4 (n = 7,020)	1.1 (-5.8;7.9)	0.759	0.9 (-3.5;5.4)	0.684	1.0 (0.8;1.2)	0.979
Group 5 (n = 11,295)	-3.1 (-11.5;5.2)	0.461	**9.8 (4.4;15.2)**	**<0.001**	1.0 (0.9;1.2)	0.516
Group 6 (n = 1,903)	-45.0 (-108.1;18.0)	0.162	**-62.1 (-102.9;-21.3)**	**0.003**	0.4 (0.1;1.5)	0.191
Group 7 (n = 5,166)	-4.3 (-14.8;6.2)	0.421	3.6 (-3.5;10.8)	0.318	1.1 (0.9;1.3)	0.453
Group 8 (n = 2,612)	-3.9 (-14.4;6.7)	0.471	-1.6 (-8.8;5.6)	0.664	0.9 (0.7;1.1)	0.256
Group 9 (n = 4,372)	**-14.3 (-27.8;-0.8)**	**0.038**	**9.1 (0.3;3.9)**	**0.042**	1.2 (1.0;1.4)	0.050

B = Coefficients of the regression analyses; OR= Odds ratio; ERI = Effort-reward imbalance; CI = Confidence interval;
Linear regression models adjusted for age, sex, BMI, education, monthly income, pack-years, smoking, alcohol consumption, and antihypertensive medication were used to investigate the association between psychosocial work factors and blood pressure.
Logistic regression models adjusted for the covariates (except antihypertensive medication) were used to investigate the association between psychosocial work factors and hypertension.
In the co-exposure analyses, regression models were adjusted for covariates and psychosocial work factors.
Group 1 = Legislators, senior officials, and managers; Group 2 = Professionals ; Group 3 = Technicians and associate professionals; Group 4 = Clerks ; Group 5 = Service workers and shop and market sales workers; Group 6 = Skilled agriculture and fishery workers ; Group 7 = Craft and related trades workers; Group 8 = Plant and machine operators and assemblers; Group 9 = Elementary occupations

Supplementary Table 7: Association between emotional demands and blood pressure (co-exposure model).

Occupational groups	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)		Hypertension	
	B (CI95%)	p-value	B (CI95%)	p-value	OR (CI95%)	p-value
Group 1 (n = 2,752)	-0.9 (-2.3;0.5)	0.205	0.7 (-0.2;1.7)	0.122	0.9 (0.7;1.2)	0.373
Group 2 (n = 15,124)	-0.1 (-0.7;0.4)	0.635	**-0.4 (-0.8;0)**	**0.033**	0.9 (0.8;1.0)	0.055
Group 3 (n = 13,294)	**-0.8 (-1.3;-0.3)**	**0.001**	0.1 (-0.3;0.4)	0.671	0.9 (0.9;1.1)	0.183
Group 4 (n = 7,020)	-0.8 (-2.5;0.9)	0.369	0.8 (-0.3;2.0)	0.164	1.0 (0.8;1.2)	0.836
Group 5 (n = 11,295)	-0.1 (-0.7;0.5)	0.742	**0.6 (0.2;1.0)**	**0.006**	1.1 (0.9;1.2)	0.346
Group 6 (n = 1,903)	**-4.5 (-8.1;-0.8)**	**0.017**	-1.1 (-3.4;1.3)	0.384	**0.7 (0.5;0.9)**	**0.003**
Group 7 (n = 5,166)	**-4.2 (-7.6;-0.9)**	**0.014**	**6.4 (4.1;8.7)**	**<0.001**	1.5 (0.5;4.4)	0.511
Group 8 (n = 2,612)	-0.2 (-2.8;2.4)	0.884	**2.9 (1.1;4.7)**	**0.002**	0.9 (0.7;1.3)	0.710
Group 9 (n = 4,372)	**-5.7 (-8.3;-3.1)**	**<0.001**	**2.2 (0.5;3.9)**	**0.010**	0.9 (0.7;1.3)	0.663

B = Coefficients of the regression analyses; OR= Odds ratio; ERI = Effort-reward imbalance; CI = Confidence interval;
Linear regression models adjusted for age, sex, BMI, education, monthly income, pack-years, smoking, alcohol consumption, and antihypertensive medication were used to investigate the association between psychosocial work factors and blood pressure.
Logistic regression models adjusted for the covariates (except antihypertensive medication) were used to investigate the association between psychosocial work factors and hypertension.
In the co-exposure analyses, regression models were adjusted for covariates and psychosocial work factors.
Group 1 = Legislators, senior officials, and managers; Group 2 = Professionals ; Group 3 = Technicians and associate professionals; Group 4 = Clerks ; Group 5 = Service workers and shop and market sales workers; Group 6 = Skilled agriculture and fishery workers ; Group 7 = Craft and related trades workers; Group 8 = Plant and machine operators and assemblers; Group 9 = Elementary occupations