

Table of Content

Supplementary Text S1. The choice of measurements, dimensions and cut-offs of workplace psychosocial resources.	2
Supplementary Text S2. Measurements of health-related lifestyle, clinical and work-related factors	3
Supplementary Figure S1. Directed acyclic graph for the hypothetical causal framework	4
Supplementary Figure S2. Workplace resources pattern in each latent class, separately estimated from wave 2000 to 2014	5
Supplementary Figure S3. Motivation of selecting a four-class model	6
Supplementary Figure S4. Associations between individual resources and type 2 diabetes, before and after mutual adjustment.	7
Supplementary Figure S5. Sensitivity analysis by follow-up periods.....	8
Supplementary Figure S6. Sensitivity analysis by additional adjustments.	9
Supplementary Figure S7. Effect modifications of the association between workplace psychosocial resource class and incident type 2 diabetes stratified by age, sex, educational level and occupational grade.....	10
Supplementary Table S1. Calculation for Charlson Comorbidity Index and diagnosis of mental disorders from hospital admissions and discharge registers using primary and secondary diagnoses.....	11
Supplementary Table S2. Proportion of individual resources in each workplace psychosocial resource pattern.....	12
Supplementary Table S3. Baseline characteristics of participants in the Finnish Public Sector Study, by workplace psychosocial resources, based on different analytical samples.	13
References.....	14

Supplementary Text S1. The choice of measurements, dimensions and cut-offs of workplace psychosocial resources.

The measure on 'support from colleagues' was derived from the Statistics Finland scale on the working climate.[1] Similar item (e.g. "my colleagues are there for me") has been used in another multicohort study on type 2 diabetes, including cohorts from Sweden, United Kingdom and France.[2] We applied the same cut-off for high versus low support from colleagues as in these previous studies, e.g. 'completely agree' and 'somewhat agree' as high support. The measure of 'collaboration' is part of the measurement of workplace social capital scale,[3] which has previously been used to investigate hypertension and mortality.[4, 5] We used median cut-offs for high versus low levels of collaboration as in papers on workplace social capital. The measure of 'procedural justice' (Moorman scale) has been applied in different contexts, e.g. in Sweden (quartile separation) [6] and in Finland (tertile separation).[7] Because this study is part of a larger research program containing other cohorts, for cohort harmonization, we selected four dimensions for measurement of 'leadership' due to data availability (three questions from The Stress Profile [8] and one item on managers listening from the relational justice scale [9]), following previous practice in another multicohort study.[10] As previously [6, 10], we used the quartile separation for both procedural justice and leadership quality.

Supplementary Text S2. Measurements of health-related lifestyle, clinical and work-related factors

Lifestyle factors: Risky alcohol consumption was defined as drinking 14 and 21 alcohol units per week (12 grams of alcohol per unit) for women and men, respectively. Physical inactivity was defined as <2.0 metabolic equivalent task hours per day (corresponding to approximately 30 minutes of walking).

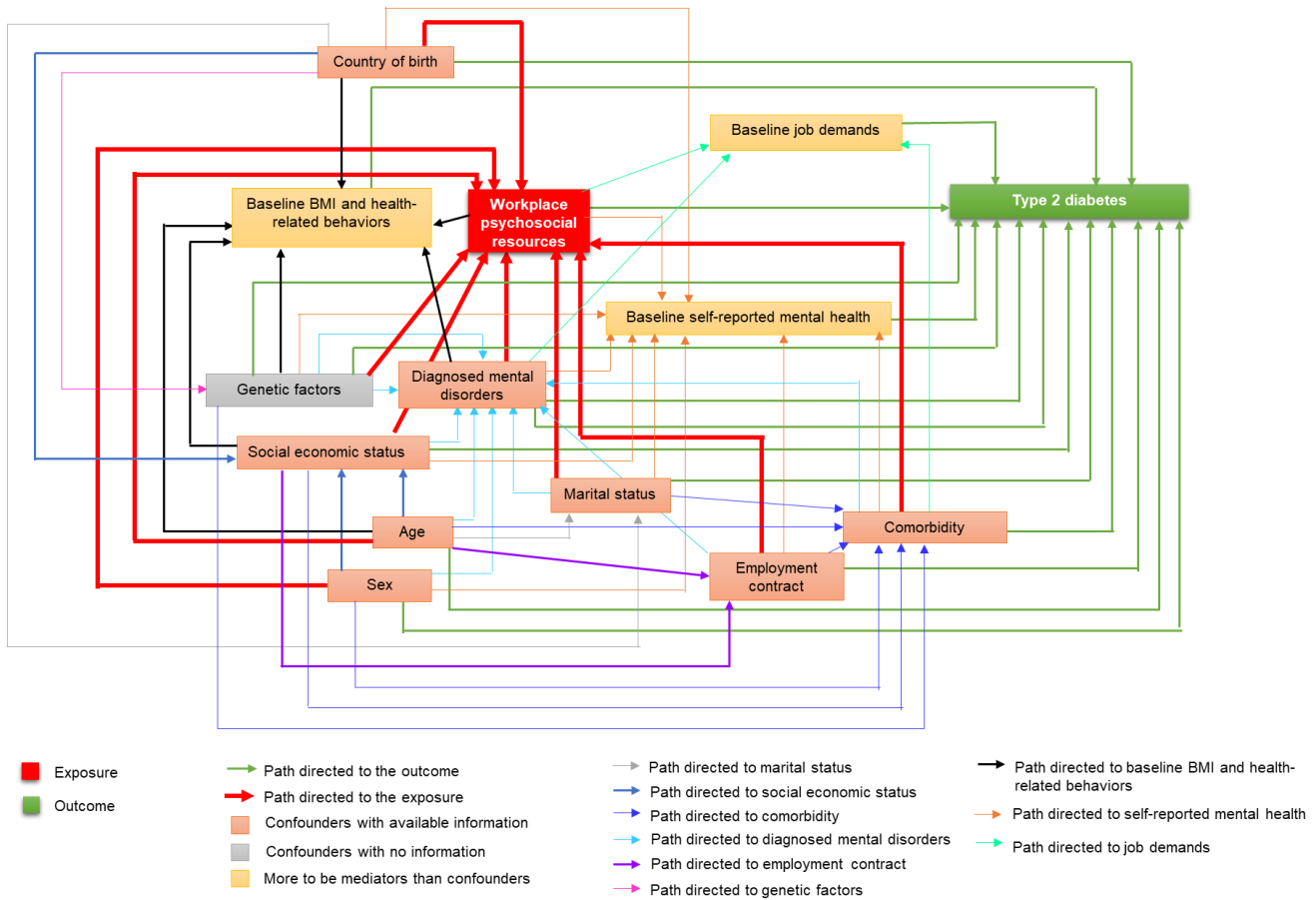
Clinical factors: Body mass index was calculated by self-reported weight and height using the formula: weight in kg / height in m². Symptoms of mental health problems, treated as a continuous measure, were measured using the General Health Questionnaire.[11]

Work-related factors: Job demands were measured using the Job Content Questionnaire, with three items measuring demands (Cronbach $\alpha = 0.77$, cut-off=3 according to median separation). [12]

Occupational grade was register-based and categorized based on the International Standard Classification of Occupations code for occupational-title into 'higher-grade non-manual employees' (high), 'lower-grade non-manual employees' (middle) and 'manual employees' (low).

Health-related behaviors, weight, height and symptoms of mental health problems were only measured in wave 2004, 2008, 2012 and 2014, except for smoking which was also measured in 2010. In contrast, work-related factors were measured in all seven waves between 2000 and 2014.

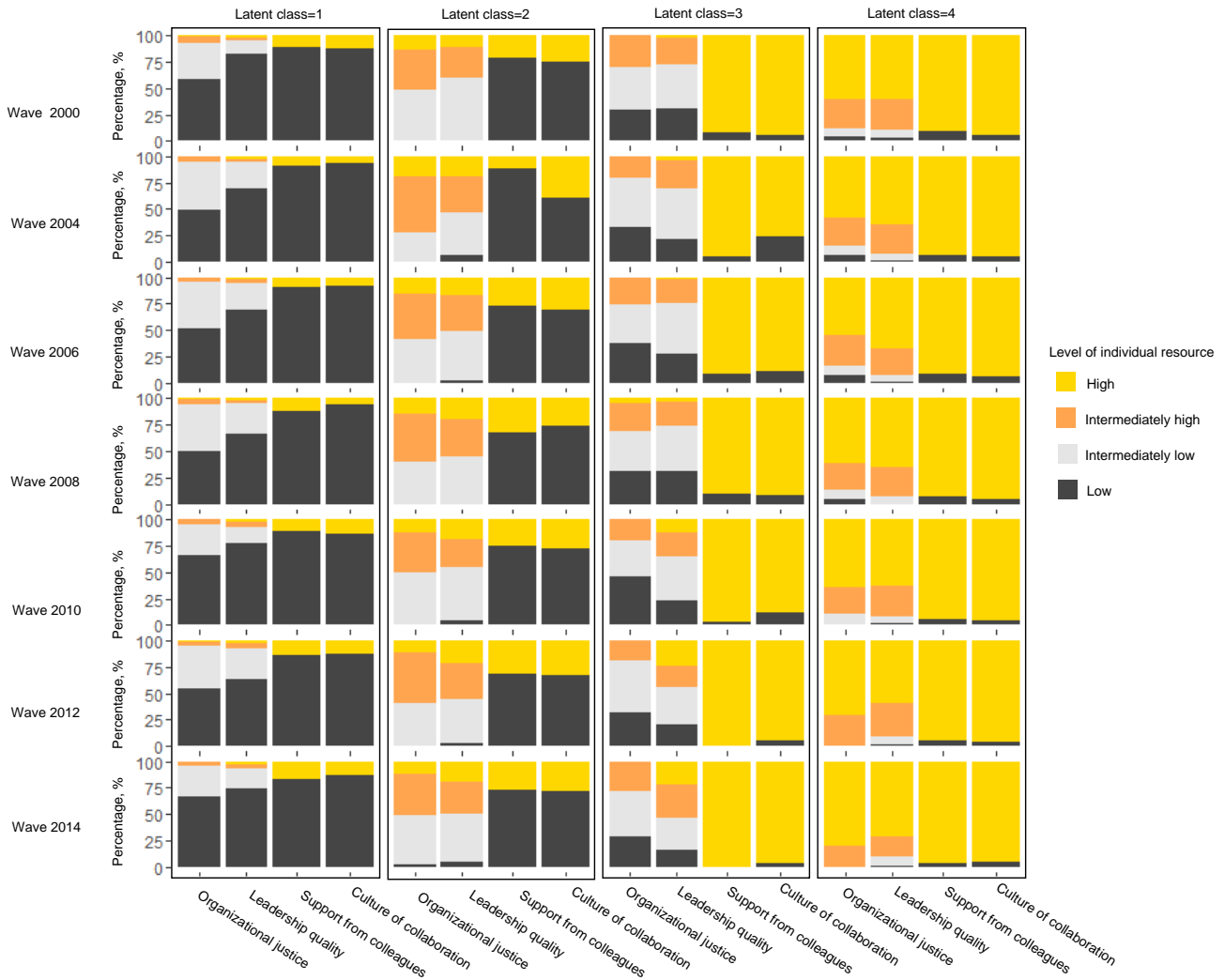
Supplementary Figure S1. Directed acyclic graph for the hypothetical causal framework



NOTE: Pathways between hypothetical mediators are omitted. Social economic status is indicated by educational level in the main analysis.

Supplementary Figure S2. Workplace resources pattern in each latent class, separately estimated from wave 2000 to 2014

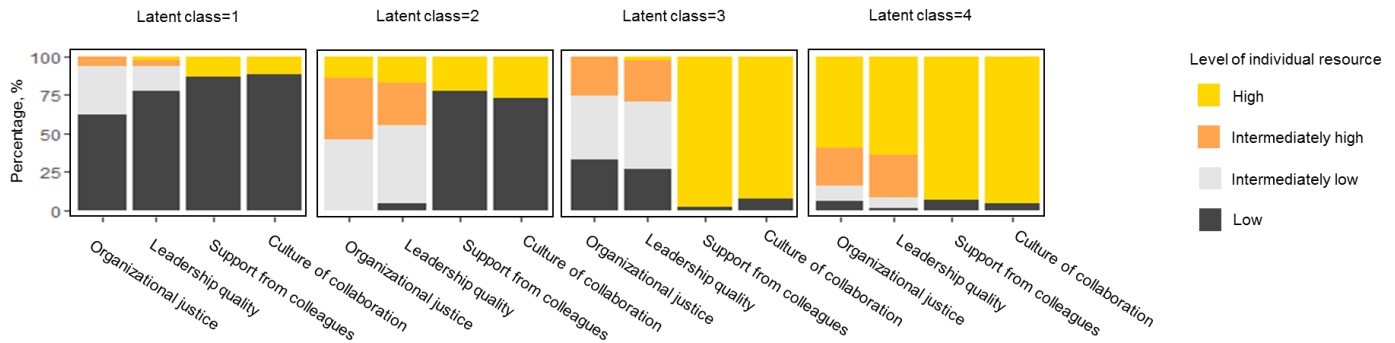
NOTE: This figure is generated using all participants in all waves, but tested separately for each wave.



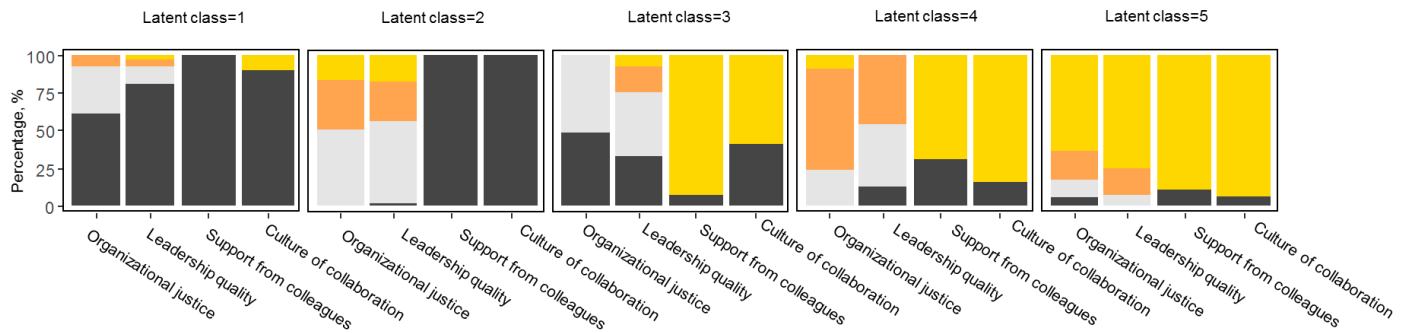
Supplementary Figure S3. Motivation of selecting a four-class model

BIC continuously decreased from a two-class model to a five-class model ($BIC_2 = 381,737$; $BIC_3 = 379,112$; $BIC_4 = 377,145$; $BIC_5 = 376,947$). The model was not convergent when adding a sixth class. The figure below shows very similar patterns in classes 4 and 5 in the five-class solution. Therefore, we decided to select the four-class model, where the class patterns were more distinct and interpretable.

a) Four-class model

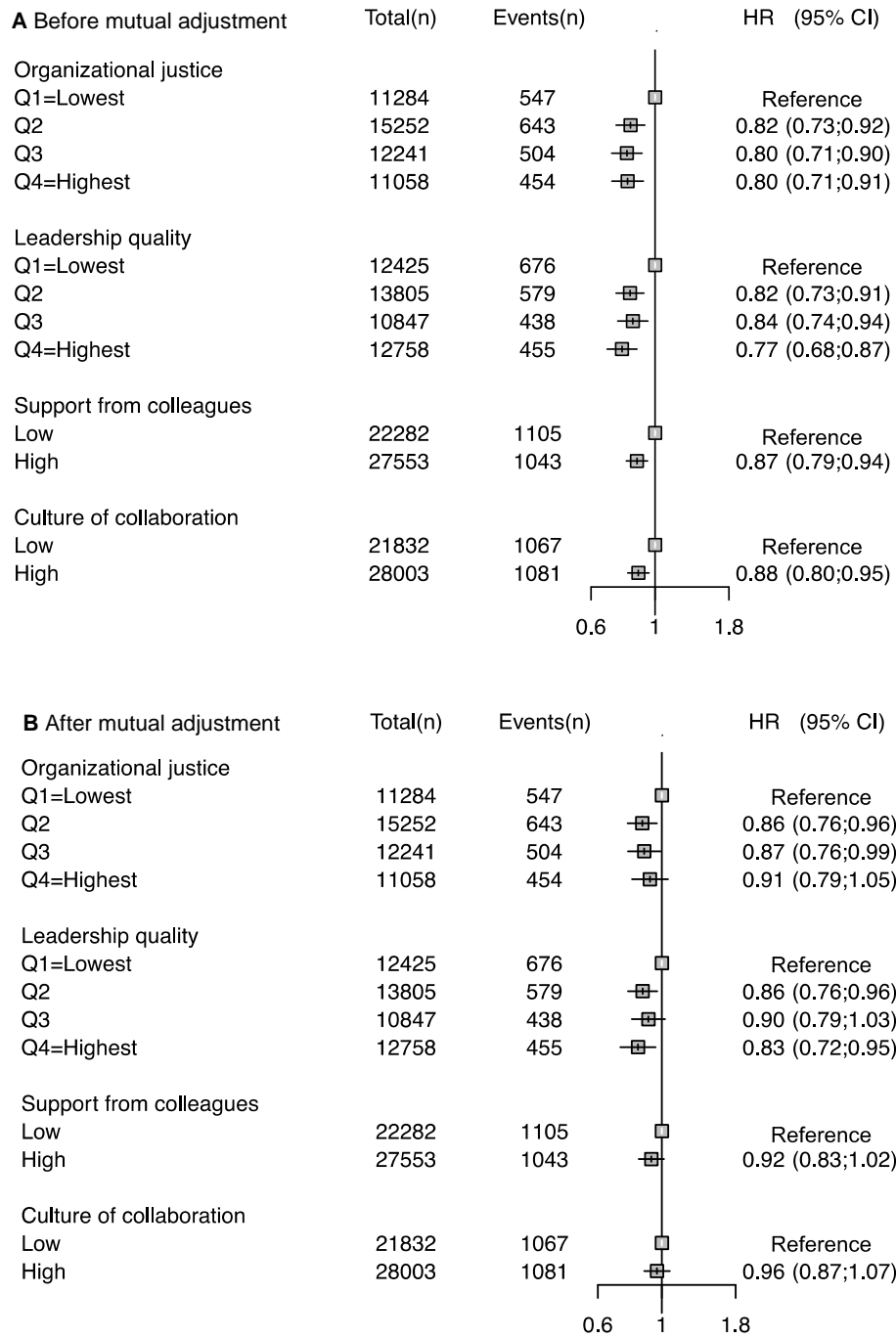


b) Five-class model

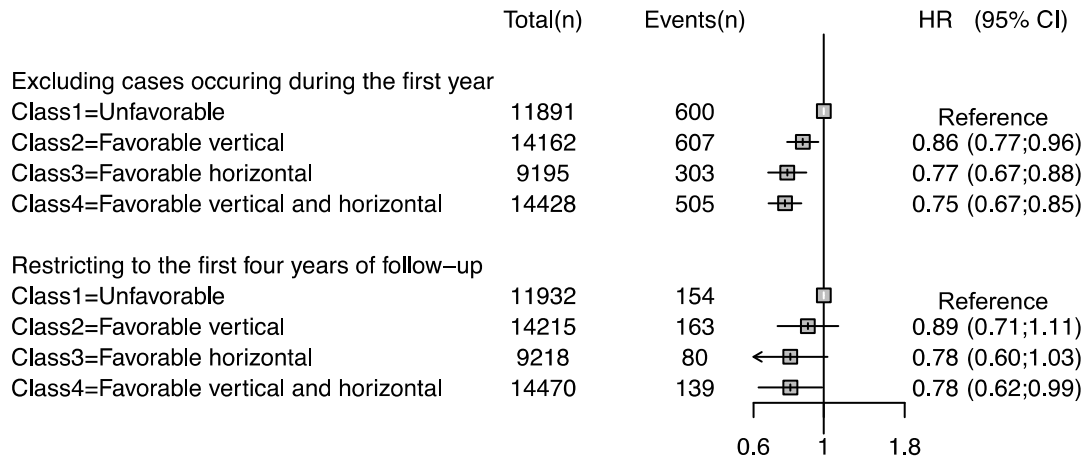


Supplementary Figure S4. Associations between individual resources and type 2 diabetes, before and after mutual adjustment.

Abbreviation: HR=Hazard Ratio



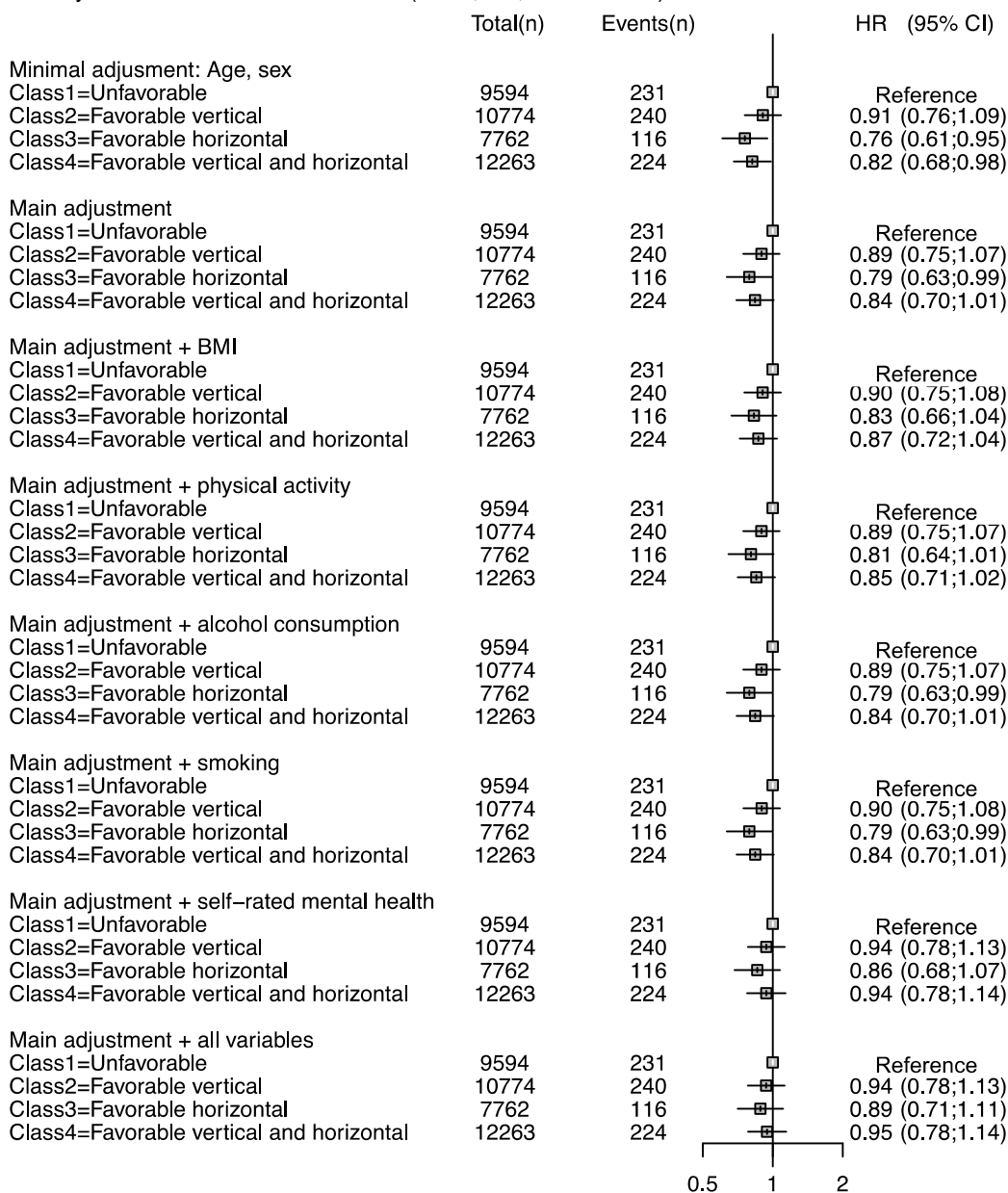
Supplementary Figure S5. Sensitivity analysis by follow-up periods ($N_{\text{one-year washout}}=49,676$; $N_{\text{follow-up lengths}}=49,835$). Abbreviation: HR=Hazard Ratio



Supplementary Figure S6. Sensitivity analysis by additional adjustments.

Abbreviation: HR=Hazard Ratio

A Lifestyle factors and mental disorders (N=40,393; N_{diabetes}=811).



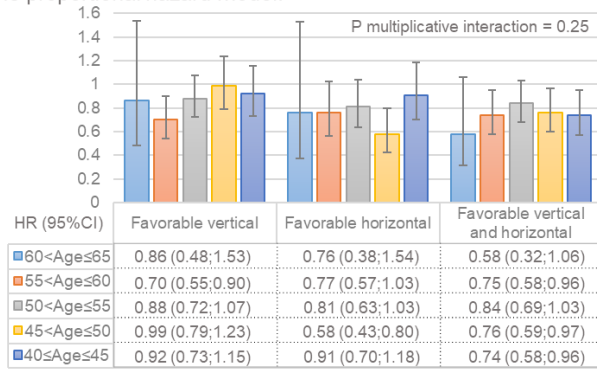
B Additionally adjusting for occupational grade in the main analysis (N=49,676) and additionally adjusting for job demands in addition to the main adjustments (N=49,485).

Adjustments	Resources	HR (95%CI)
Main adjustment + occupation	Class1=Unfavorable	Reference
Main adjustment + occupation	Class2=Favorable vertical	0.87 (0.78;0.97)
Main adjustment + occupation	Class3=Favorable horizontal	0.77 (0.67;0.88)
Main adjustment + occupation	Class4=Favorable vertical and horizontal	0.78 (0.70;0.88)
Main adjustment + job demands	Class1=Unfavorable	Reference
Main adjustment + job demands	Class2=Favorable vertical	0.88 (0.79;0.99)
Main adjustment + job demands	Class3=Favorable horizontal	0.79 (0.69;0.90)
Main adjustment + job demands	Class4=Favorable vertical and horizontal	0.78 (0.69;0.88)

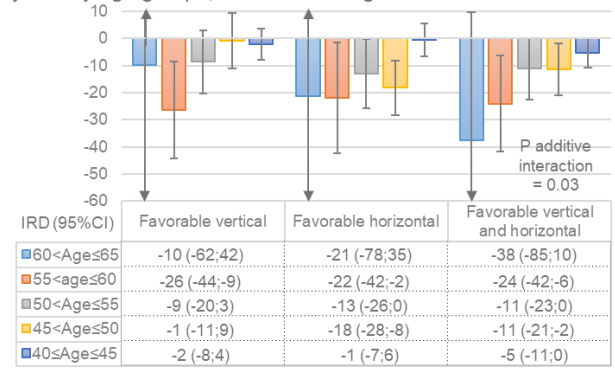
Supplementary Figure S7. Effect modifications of the association between workplace psychosocial resource class and incident type 2 diabetes stratified by age, sex, educational level and occupational grade.

Abbreviation: HR=Hazard Ratio; IRD=Incident Rate Difference.

A Stratified hazard ratios (HR) by age groups, calculated using the proportional hazard model.

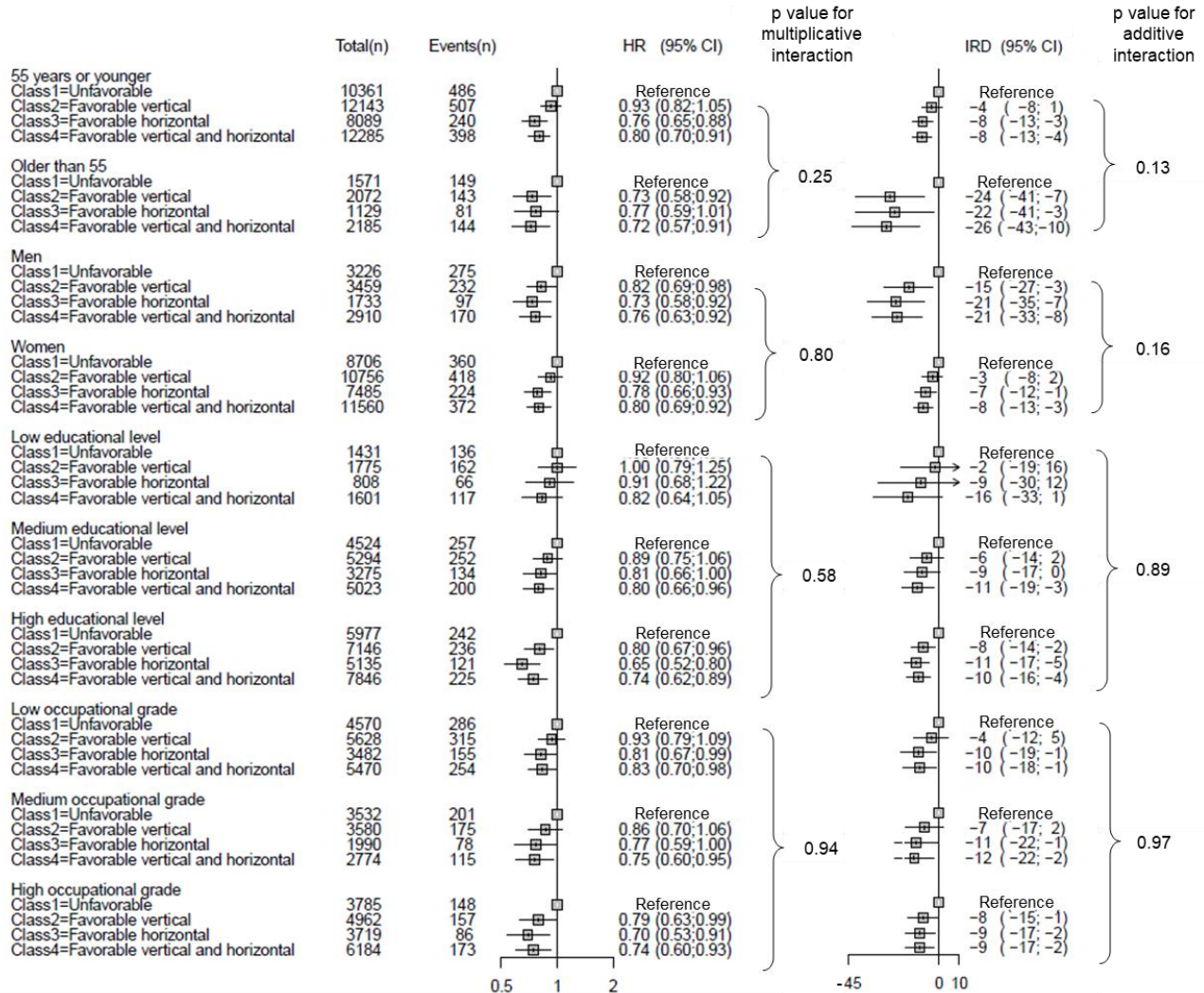


B Stratified incidence rate difference (IRD) per 10,000 person-years by age groups, calculated using the additive hazard model



Age as a continuous variable: $P_{\text{multiplicative}} = 0.66$; $P_{\text{additive}} = 0.04$.

C Stratified results by age groups (dicotimized), sex, educational levels and occupational grades.



Supplementary Table S1. Calculation for Charlson Comorbidity Index and diagnosis of mental disorders from hospital admissions and discharge registers using primary and secondary diagnoses (information for pre-existing diabetes was also taken from the ICD code mentioned in this table)

Condition	Weights	ICD-8	ICD-9	ICD-10
Acute myocardial infarction	1	410	410, 412	I21, I22, I252
Congestive heart failure	1	427.09; 427.10; 427.11; 427.19; 428.99; 782.49	428	I50
Peripheral vascular disease	1	440; 441; 442; 443; 444; 445	441, 4439, 7854, V434	I71, I790, I739, R02, Z958, Z959
Cerebral vascular accident	1	430–438	430–438	I60, I61, I62, I63, I65, I66, G450, G451, G452, G458, G459, G46, I64, G454, I670, I671, I672, I674, I675, I676, I677, I678, I679, I681, I682, I688, I69
Dementia	1	290.09–290.19; 293.09	290	F00, F01, F02, F051
Pulmonary disease	1	490–493; 515–518	490, 491, 492, 493, 494, 495, 496, 500, 501, 502, 503, 504, 505	J40, J41, J42, J44, J43, J45, J46, J47, J67, J44, J60, J61, J62, J63, J66, J64, J65
Connective tissue disorder	1	712; 716; 734; 446; 135.99	7100, 7101, 7104, 7140, 7141, 7142, 71481(now 5171), 725	M32, M34, M332, M053, M058, M059, M060, M063, M069, M050, M052, M051, M353
Peptic ulcer	1	530.91; 530.98; 531–534	531, 532, 533, 534	K25, K26, K27, K28
Liver disease	1	571; 573.01; 573.04	5712, 5714, 5715, 5716	K702, K703, K73, K717, K740, K742, K746, K743, K744, K745
Diabetes	1	249.00; 249.06; 249.07; 249.09 250.00; 250.06; 250.07; 250.09	2500,2501, 2502, 2503, 2507	E109, E119, E139, E149, E101, E111, E131, E141, E105, E115, E135, E145
Diabetes complications	2	249.01–249.05; 249.08 250.01–250.05; 250.08	2504, 2505, 2506	E102, E112, E132, E142 E103, E113, E133, E143 E104, E114, E134, E144
Paraplegia	2	344	342, 3441	G81 G041, G820, G821, G822
Renal disease	2	403; 404; 580–583; 584; 590.09; 593.19; 753.10–753.19; 792	582, 5830, 5831, 5832, 5833, 5835, 5836, 5837, 5834, 585, 586, 588	N03, N052, N053, N054, N055, N056, N072, N073, N074, N01, N18, N19, N25
Cancer	2	140–194 204–207 200–203; 275.59	14, 15, 16, 18, 170, 171, 172, 174, 175, 176, 179, 190, 191, 192, 193, 194, 1950, 1951, 1952, 1953, 1954, 1955, 1958, 200, 201, 202, 203, 204, 205, 206, 207, 208	C0, C1, C2, C3, C40, C41, C43, C45, C46, C47, C48, C49, C5, C6, C70, C71, C72, C73, C74, C75, C76, C80, C81, C82, C83, C84, C85, C883, C887, C889, C900, C901, C91, C92, C93, C940, C941, C942, C943, C9451, C947, C95, C96
Metastatic cancer	6	195–198; 199	196, 197, 198, 1990, 1991	C77, C78, C79, C80
Severe liver disease	3	070.00; 070.02; 070.04; 070.06; 070.08; 573.00; 456.00–456.09	5722, 5723, 5724, 5728	K729, K766, K767, K721
HIV	6	79.83	042, 043, 044	B20, B21, B22, B23, B24

Diagnosed mental disorders: ICD-10 F01-F99.

Supplementary Table S2. Proportion of individual resources in each workplace psychosocial resource pattern.

A Original proportion

	Proportion, %			
	Class=1 Unfavorable	Class=2 Favorable vertical	Class=3 Favorable horizontal	Class=4 Favorable vertical and horizontal
Procedural justice				
Low	62.6	1.2	39.5	0
Intermediately low	31.4	45.3	38.9	10.2
Intermediately high	6.0	40.4	21.7	26.2
High	0	13.1	0	63.6
Leadership quality				
Low	77.7	5.5	23.1	1.7
Intermediately low	16.1	49.8	40.8	7.2
Intermediately high	3.8	27.8	23.6	29.5
High	2.5	16.9	12.4	61.6
Co-worker support				
Low	86.8	76.6	1.6	6.1
High	13.2	23.4	98.4	93.9
Culture of collaboration				
Low	88.3	72.1	4.5	4.4
High	11.7	27.9	95.5	95.6

B Combined proportion

Workplace resource	Unfavorable, %	Favorable vertical = Intermediate/high vertical + low horizontal, %	Favorable horizontal = Intermediate/low + high horizontal, %	Favorable vertical and horizontal, %
Organizational justice	General high: 6.0	Intermediate to high: 98.8	High: 0	General high: 89.8
Leadership quality	General high: 6.3	Intermediate to high: 94.5	High: 12.4	General high: 91.1
Support from colleagues	General high: 13.2	General high: 23.4	General high: 98.4	General high: 93.9
Culture of collaboration	General high: 11.7	General high: 27.9	General high: 95.5	General high: 95.6

NOTE: General high = High + Intermediately high; Intermediate to high = General high + Intermediately low.

Supplementary Table S3. Baseline characteristics of participants in the Finnish Public Sector Study, by workplace psychosocial resources, based on different analytical samples.

	Sample size	Total sample	Unfavorable	Favorable vertical	Favorable horizontal	Favorable vertical and horizontal	p-value **
<u>Social demographic characteristics</u>							
Age, mean	49,835	48	48	48	47	48	<0.001
Female sex, %	49,835	77	73	76	81	80	<0.001
Educational level, %	49,835						<0.001
Low		11	12	12	9	11	
Medium		36	38	37	36	35	
High		52	50	50	56	54	
Marital status, %	49,835						<0.001
Married or cohabiting		76	74	76	77	78	
Single		9	10	9	8	8	
Divorced or separated		13	14	13	13	13	
Widowed		2	1	2	2	2	
<u>Clinical characteristics</u>							
Charlson Comorbidity Index ≥ 1 , %	49,835	9	9	9	8	8	0.60
Diagnosed mental disorders, %	49,835	2	2	1	1	2	0.04
Self-reported mental health, (mean)*	40,393	22	35	23	21	12	<0.001
Body mass index, mean	40,393	26	26	26	26	25	<0.001
<u>Work-related characteristics</u>							
Non-permanent job contract, %	49,835	10	7	11	9	13	<0.001
Occupational grade, %	49,676						<0.001
Low		39	38	40	38	38	
Medium		24	30	25	22	19	
High		38	32	35	40	43	
High job demands, %	49,485	49	60	47	53	39	<0.001
<u>Lifestyle characteristics</u>							
Physical inactivity, %	40,393	37	40	39	35	35	<0.001
Risky alcohol consumption, %	40,393	9	11	9	10	8	<0.001
Smoking, %	40,393	15	18	15	15	13	<0.001

* Higher score indicates a poorer mental health condition.

** p-values for testing the hypothesis that at least one group is different from the others; ANOVA tests performed for continuous characteristics and chi-square tests performed for categorical characteristics.

References

1. Lehto, A.-M., *Quality of working life and equity*. Helsinki, Finland: Statistics Finland, 1991.
2. Mortensen, J., et al., *Informal caregiving as a risk factor for type 2 diabetes in individuals with favourable and unfavourable psychosocial work environments: A longitudinal multi-cohort study*. *Diabetes & Metabolism*, 2018. **44**(1): p. 38-44.
3. Kouvonen, A., et al., *Psychometric evaluation of a short measure of social capital at work*. *BMC Public Health*, 2006. **6**(1): p. 251.
4. Oksanen, T., et al., *Workplace social capital and risk of chronic and severe hypertension: a cohort study*. *Journal of hypertension*, 2012. **30**(6): p. 1129-1136.
5. Oksanen, T., et al., *Workplace social capital and all-cause mortality: A prospective cohort study of 28 043 public-sector employees in Finland*. *American journal of public health*, 2011. **101**(9): p. 1742-1748.
6. Persson, V., et al., *Effects of procedural justice on prospective antidepressant medication prescription: a longitudinal study on Swedish workers*. *BMC public health*, 2020. **20**: p. 1-9.
7. Lallukka, T., et al., *Change in organizational justice as a predictor of insomnia symptoms: longitudinal study analysing observational data as a non-randomized pseudo-trial*. *International Journal of Epidemiology*, 2017. **46**(4): p. 1277-1284.
8. Setterlind, S. and G. Larsson, *The stress profile: A psychosocial approach to measuring stress*. *Stress Medicine*, 1995. **11**(1): p. 85-92.
9. Elovainio, M., M. Kivimäki, and J. Vahtera, *Organizational justice: evidence of a new psychosocial predictor of health*. *American journal of public health*, 2002. **92**(1): p. 105-108.
10. Madsen, I.E.H., et al., *Does good leadership buffer effects of high emotional demands at work on risk of antidepressant treatment? A prospective study from two Nordic countries*. *Social psychiatry and psychiatric epidemiology*, 2014. **49**(8): p. 1209-1218.
11. Goldberg, D.P. and B. Blackwell, *Psychiatric illness in general practice: a detailed study using a new method of case identification*. *Br med J*, 1970. **2**(5707): p. 439-443.
12. Laine, S., et al., *Job strain as a predictor of disability pension: the Finnish Public Sector Study*. *Journal of Epidemiology & Community Health*, 2009. **63**(1): p. 24-30.