Heterogeneity of psychosocial exposures within occupational groups: A latent profile analysis in manufacturing

Heterogeneidade das exposições psicossociais dentro de grupos ocupacionais: análise de perfis latentes na indústria

Heterogeneidad de exposiciones psicosociales dentro de grupos ocupacionales: análisis de perfiles latentes en la industria

Empirical research report

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Abstract: This cross-sectional study characterized psychosocial exposure profiles in 672 workers from a Portuguese manufacturing company, including 424 blue-collar and 248 white-collar workers. Latent profile analyses were estimated separately by occupational group using 22 COPSOQ III scales. Considering fit, profile size, and stability, exploratory four-profile and two-profile solutions were retained, respectively. Outcome comparisons incorporated classification uncertainty and resampling. Configurations with higher demands and fewer resources showed more burnout, stress, sleeping troubles, depressive symptoms, and work-life conflict, poorer self-rated health, and lower satisfaction. Sociodemographic associations remained inconclusive, and absenteeism did not significantly distinguish profiles. The findings describe within-occupation heterogeneity without establishing causality or structural differences between occupational groups.
Keywords: occupational health, working conditions, psychosocial factors, psychological well-being, latent profile analysis.

Resumo: Este estudo transversal caracterizou perfis de exposições psicossociais em 672 trabalhadores de uma indústria portuguesa, incluindo 424 operacionais e 248 administrativos. Análises de perfis latentes foram estimadas separadamente por grupo ocupacional, com 22 escalas do COPSOQ III. Considerando ajuste, dimensão dos perfis e estabilidade, foram retidas soluções exploratórias de quatro e dois perfis, respectivamente. Comparações de desfechos incorporaram a incerteza de classificação e reamostragem. Configurações com demandas maiores e recursos menores apresentaram mais burnout, estresse, problemas de sono, sintomas depressivos e conflito trabalho-vida, pior saúde percebida e menor satisfação. As associações sociodemográficas permaneceram inconclusivas, e o absenteísmo não diferenciou significativamente os perfis. Os resultados descrevem heterogeneidade intraocupacional, sem estabelecer causalidade ou diferenças estruturais entre grupos.
Palavras-chave: saúde ocupacional, condições de trabalho, fatores psicossociais, bem-estar psicológico, análise de perfis latentes.

Resumen: Este estudio transversal caracterizó perfiles de exposiciones psicosociales en 672 trabajadores de una industria portuguesa, incluidos 424 operarios y 248 administrativos. Se estimaron análisis de perfiles latentes por separado para cada grupo ocupacional mediante 22 escalas del COPSOQ III. Considerando ajuste, tamaño de los perfiles y estabilidad, se retuvieron soluciones exploratorias de cuatro y dos perfiles, respectivamente. Las comparaciones de resultados incorporaron incertidumbre de clasificación y remuestreo. Las configuraciones con mayores demandas y menores recursos mostraron más burnout, estrés, problemas de sueño, síntomas depresivos y conflicto trabajo-vida, peor salud percibida y menor satisfacción. Las asociaciones sociodemográficas permanecieron inconclusas y el absentismo no diferenció significativamente los perfiles. Los resultados describen heterogeneidad intraocupacional, sin establecer causalidad ni diferencias estructurales entre grupos.
Palabras clave: salud laboral, condiciones de trabajo, factores psicosociales, bienestar psicológico, análisis de clases latentes.

Introduction

Research on psychosocial work conditions has been constrained by persistent terminological imprecision. Teixeira et al. (2025), in an integrative review of 24 empirical studies published between 2017 and 2021, documented that the terms "psychosocial risks" and "psychosocial risk factors" are used interchangeably across a substantial portion of the literature despite designating distinct constructs: the former refers to negative health outcomes resulting from exposure, the latter to the specific working conditions that generate those outcomes. Their analysis proposed an integrative definition framing psychosocial risk as the interaction among structural, organizational, social, and individual conditions, and advocated for empirical operationalization through validated multidimensional instruments such as the Copenhagen Psychosocial Questionnaire. The distinction has substantive consequences. When organizational interventions target risks without first characterizing the configurations of working conditions that produce them, they risk addressing surface symptoms rather than the conditions that generate strain.

The scale of the problem is well documented. The International Labour Organization (2026) estimated that occupational psychosocial risk factors account for more than 840,000 deaths annually, nearly 45 million disability-adjusted life years lost each year, and economic costs equivalent to 1.37% of global GDP. Niedhammer, Sultan-Taïeb, et al. (2022), drawing on European working conditions survey data and meta-analyzed risk estimates, likewise estimated substantial cardiovascular and mental disorder burdens attributable to job strain, effort-reward imbalance, and job insecurity. These population estimates establish the importance of prevention but do not describe how demands and resources combine within a particular workplace.

Three theoretical traditions structure how these working conditions are conceptualized. Karasek (1979) proposed that the combination of high psychological demands with low decision latitude produces the strain most damaging to worker health, and Johnson and Hall (1988) extended this framework with social support as a third axis, identifying iso-strain (the simultaneous co-occurrence of high demands, low control, and low support) as the most adverse configuration. The Job Demands-Resources model (Bakker & Demerouti, 2007) generalized this logic into a framework applicable across occupational settings, describing a health-impairment process driven by demands and a motivational process sustained by resources. Bakker et al. (2023), in a ten-year review of the model, emphasized that the specific demands and resources relevant to well-being vary by occupational context and that their effects and interactions depend on context. A complementary account comes from Conservation of Resources theory (Hobfoll, 2011), which holds that work resources rarely operate in isolation but accumulate or deplete together as interconnected sets sustained by structural features of the workplace. The Copenhagen Psychosocial Questionnaire in its third international version (COPSOQ III; Burr et al., 2019) operationalizes this theoretical tradition through multiscale assessment covering demands, work-content resources, interpersonal and leadership conditions, employment insecurity, and organizational trust and justice. The Portuguese middle version was adapted and psychometrically validated by Cotrim et al. (2022) in municipal and healthcare samples.

Variable-centered and person-centered methods address complementary questions. The former estimate associations between measured dimensions and can explicitly test interactions; the latter describe subgroups with similar patterns across several indicators. Latent profile analysis (LPA) represents this heterogeneity through probabilistic membership in a finite set of profiles, conditional on distributional assumptions and model-selection decisions (Spurk et al., 2020). Identifying profiles does not itself demonstrate demand-resource interactions or causal mechanisms. Gameiro et al. (2020) identified demand-control configurations in a large Portuguese occupational sample. Portoghese et al. (2020, 2025) identified related patterns in Italian healthcare workers and examined their associations with burnout, motivation, and workplace stressors. These studies support examining combinations of working conditions alongside their individual dimensions.

Occupational group is relevant to both average exposure and within-group variation. Manual and knowledge-intensive work may differ in task organization, autonomy, and resource distribution. Metzler and Bellingrath (2017), studying blue- and white-collar workers in the European steel industry with COPSOQ, documented occupational differences in psychosocial conditions. Estimating profiles separately allows within-group patterns to be described without requiring a common profile solution. However, differences in the selected number of profiles do not establish measurement non-invariance or demonstrate that stratified models outperform pooled or multigroup models. Such comparisons require dedicated tests that are beyond the present descriptive analysis.

Industrial workers face substantial physical and psychosocial demands (Vinstrup et al., 2021), yet their within-occupation exposure configurations warrant further study. This study applied stratified LPA to 672 workers from a Portuguese manufacturing company using 22 COPSOQ III-PT exposure scales. We asked which profiles characterized each occupational group; whether exposure-defined profiles differed on well-being outcomes and absenteeism; and, secondarily, whether sociodemographic characteristics were associated with profile membership. Higher demands

combined with fewer resources were expected to accompany less favorable well-being. These questions were exploratory; the analysis did not test causal effects or formal differences between occupational profile structures.

Method

Study Design and Participants

This cross-sectional study used a company-based sample of 672 workers from Company A, a manufacturing firm in central Portugal. Eligibility required current employment, at least six months of work experience, and proficiency in Portuguese.

Of the 672 participants, 424 were classified as blue-collar (63.1%) and 248 as white-collar (36.9%), based on a job classification adapted to the company. A second company (Company B, n = 92) that participated in the original data collection phase was excluded from the present analyses because its sample size was insufficient to support stratified latent profile analyses within occupational substrata. All analyses reported here therefore pertain to Company A.

Instruments

Psychosocial Work Exposures. Participants completed the Portuguese middle version of the Copenhagen Psychosocial Questionnaire (COPSOQ III; Burr et al., 2019; Cotrim et al., 2022), an 85-item instrument measuring 31 psychosocial scales relevant to occupational health. Items are rated on five-point scales with anchors that follow item phrasing: most items use frequency options ranging from never to always or intensity options ranging from none to extremely, and self-rated health ranges from excellent to poor (Cotrim et al., 2022). Representative exposure items, translated here from the Portuguese version, include "Do you have to work very fast?" (work pace), "Can you influence the amount of work assigned to you?" (influence at work), "Is your work recognized and appreciated by top management?" (recognition), "Do you worry about becoming unemployed?" (job insecurity), and "Are conflicts resolved in a fair way?" (organizational justice). Scale scores were computed as pro-rated means, requiring at least 50% of valid items per scale, in line with COPSOQ International Network guidelines (Burr et al., 2019). Two items (Q6 from Cognitive Demands and Q27 from Commitment to the Workplace) were excluded prior to scale score computation because they showed standardized factor loadings below .40 in a confirmatory factor analysis conducted on the full industrial sample from which the present data were drawn. Internal consistency for the 22 retained scales used as profile indicators ranged from α = .64 to α = .89 (median = .81).

Twenty-two scales served as LPA indicators across five conceptual domains: work demands; work-content resources; interpersonal and leadership conditions; employment insecurity; and organizational trust and justice. The individual scales are listed in Tables 2 and 3. Quality of Work, a single-item measure overlapping conceptually with satisfaction, and Self-Efficacy, an individual rather than work-condition resource, were excluded. Well-being scales were analyzed separately, avoiding direct overlap between the profile indicators and the outcomes (Spurk et al., 2020). Scores retained their original directions: higher demands, role conflicts, insecurity, and the negatively oriented horizontal-trust score denote more adverse conditions; higher scores on the remaining exposure scales denote more favorable conditions.

Well-Being Outcomes. Seven COPSOQ III measures were analyzed as distal outcomes: Burnout, Stress, Sleeping Troubles, Depressive Symptoms, Self-rated Health, Job Satisfaction, and Work-Life Conflict. None entered profile estimation. Example items are "Have you felt emotionally exhausted?" (burnout) and "Have you had difficulty falling asleep?" (sleeping troubles). Higher values indicate more symptoms or conflict and greater satisfaction. Self-rated health (item 75) is coded from 1 (excellent) to 5 (poor), so higher scores indicate poorer perceived health. These outcomes provide concurrent associations rather than independent external validation, because they were collected with the exposure measures.

Absenteeism. Participants reported days absent from work during the preceding 12 months in five categories: none; up to 7 days; 8–30 days; 31–90 days; and 91–365 days. The final inferential analysis contrasted any absence with none. The five-category distribution was retained descriptively because some classification-corrected category estimates were inadmissible.

Sociodemographic Variables. Sex, age, educational attainment, and organizational tenure were collected. Regression contrasts used male versus female, up to secondary versus higher education, ages 30–39 and 40 or older versus up to 29, and original tenure categories 3–4 (2–10 years) and 5 (10 years or more) versus categories 1–2 (up to two years). Four blue-collar and three white-collar participants reporting another sex category or preferring not to answer were excluded only from the binary-sex regression, leaving 420 and 245 cases. They remained in the LPA and outcome analyses. Occupational group defined the strata.

Data Collection and Ethical Procedures

Data were collected between July and September 2023. After direct contact by the research team, each company invited its workers and organized the sessions, scheduling specific time slots and a dedicated room on its premises where the online questionnaire was completed on tablets.

Questionnaires were administered through Qualtrics (n = 641; 95.4%) or on paper when workstation access was not feasible (n = 31; 4.6%). Participation was voluntary and anonymous, and written informed consent was obtained. The consent form described the study purpose and the confidentiality and anonymity safeguards, and the online questionnaire became accessible only after consent was given. The protocol was approved by the Ethics Committee for Research in Social Sciences and Humanities of the University of Minho (approval number: CEICSH 012/2023 on 6 March 2023) and followed the Declaration of Helsinki.

Data Analysis Procedures

Latent Profile Analysis. Separate Gaussian mixtures with one to seven profiles and diagonal covariance structures (EII, VII, EEI, VVI) were explored in R using mclust (Scrucca et al., 2016). Indicators were standardized within occupational group. Multiple starts and numerical checks were used; the best log-likelihood was required to recur within .001 in at least two independent initializations for qualified multi-profile fits. This criterion reduces sensitivity to local solutions but cannot prove a global maximum. The final analysis used R 4.5.2 and mclust 6.1.2.

Selection considered BIC (reported as −2 log-likelihood plus the parameter penalty; lower is better), entropy, posterior probabilities, profile size, and split-half stability (Masyn, 2013; Nylund-Gibson & Choi, 2018). Size screening required at least 20 workers and 5% of a stratum per profile. Parametric bootstrap likelihood-ratio tests (BLRT; Nylund et al., 2007) used 499 requested replicates per comparison; unresolved replicates were reported with worst-case p-value bounds. The retained EEI four-profile blue-collar and VII two-profile white-collar solutions were pragmatic exploratory choices after numerical review, not prespecified or uniformly favored by fit criteria. EEI permits indicator-specific variances shared across profiles; VII uses equal indicator variances within a profile, differing across profiles. The full search and alternative solutions are supplied in the supplement.

Profile Stability. Stability was examined over 50 random half-sample partitions for each candidate solution. Independently fitted profiles were matched one-to-one using signed centroid correlations, with centroids expressed in the same full-sample standardized metric. We summarized signed correlations, centroid root-mean-square error, and the adjusted Rand index (ARI; Hubert & Arabie, 1985) between classifications predicted by the two half-sample models on the full stratum. Negative correlations were retained. Percentiles describe variation over overlapping partitions rather than independent-sample confidence intervals. These procedures assess internal stability, not replication in another organization.

Predictors of Profile Membership. Sociodemographic associations were examined as supplementary exploratory analyses using a three-step multinomial maximum-likelihood model corrected for classification error (Asparouhov & Muthén, 2014). The classification-error matrix was estimated among cases eligible for regression while retaining the full-sample exposure model. Reference profiles were P4 for blue-collar and P1 for white-collar workers. Bootstrap inference was withheld when fewer than 95% of requested replicates met the numerical qualification criteria.

Well-Being Outcomes by Profile. Distal means and the probability of any absence were estimated using Bolck–Croon–Hagenaars (BCH) weights to account for classification error (Asparouhov & Muthén, 2021; Bolck et al., 2004). Signed weights were retained, without truncation. In 499 nonparametric bootstrap samples per stratum, workers were resampled, indicators restandardized, profiles refitted and matched to the reference, and correction matrices re-estimated. Percentile 95% intervals and Wald tests based on bootstrap covariance were reported when at least 475 replicates qualified. Holm (1979) adjustments were applied separately within each stratum to eight outcome omnibus tests, all pairwise outcome contrasts, and all non-intercept regression contrasts. Intervals are unadjusted and conditional on successful estimation and the chosen model family and profile count; model-selection uncertainty is not included. The supplement contains formulas, diagnostics, and all contrasts.

Results

Analytic Sample

All 672 workers had complete values on the 22 supplied exposure-scale scores: 424 blue-collar (63.1%) and 248 white-collar (36.9%). There were no scale-level exclusions from profile estimation. The regression-only exclusions described above did not change the profile-estimation sample.

Model Selection

Table 1 compares the retained working models with the main alternatives. The complete grid, optimization diagnostics, and BLRT results are included in the reproducibility supplement. Different covariance families were considered in both strata.

Table 1

Fit and Internal Stability of the Working Models and Main Alternatives

Model	BIC	Smallest *n* (%)	Entropy	Split *r*	Split ARI
Blue-collar (*N* = 424)					
EEI / 4	**23,996.24**	**31 (7.3)**	**.898**	**.749**	**.516**
EEI / 5	23,962.88	25 (5.9)	.893	.598	.426
EEI / 6	23,957.83	25 (5.9)	.893	.620	.369
VVI / 4	24,035.08	47 (11.1)	.914	.829	.439
White-collar (*N* = 248)					
VII / 2	**14,668.90**	**115 (46.4)**	**.892**	**.935**	**.707**
VII / 3	14,520.16	14 (5.6)	.929	—	—
VVI / 3	14,640.22	19 (7.7)	.942	.492	.402

Note. Lower BIC indicates better fit under the information criterion. Smallest *n* = smallest modal profile count. *r* = mean signed centroid correlation; ARI = mean adjusted Rand index between half-model predictions on the full stratum. Stability values summarize all valid pairs (50 requested), not only optimization-qualified pairs. Bold rows are the working solutions. Size screening required n ≥ 20 and ≥ 5% per profile; — = split-half stability not estimated because the solution failed the size screen. Full grids and BLRT diagnostics are supplementary.

Blue-Collar Workers

The EEI four-profile solution had sizes of 136, 105, 31, and 152 workers and BIC = 23,996.24. EEI solutions with five and six profiles had lower BIC values (23,962.88 and 23,957.83), and the qualified BLRT comparisons favored these additions (both p ≈ .002; worst-case upper bounds .038 and .020). Thus, statistical fit did not uniquely support four profiles. Four profiles were retained as a simpler description with better internal stability than these larger alternatives. The smallest retained profile comprised 7.3% of workers, and its interpretation remains provisional.

White-Collar Workers

The VII two-profile solution yielded groups of 133 and 115 workers (BIC = 14,668.90). Re-optimized VVI three-profile and VII three-profile models had lower BIC values (14,640.22 and 14,520.16), but their smallest profiles contained only 19 and 14 workers, respectively, failing the absolute-size screen. VVI three-profile stability was also poor. Only 392/499 replicates qualified for the VII one-versus-two BLRT and 430/499 for two versus three; corresponding worst-case p-value upper bounds were .216 and .140. These tests were therefore not treated as conclusive evidence for a particular profile count. Two profiles were retained for size, parsimony, and internal stability.

Profile Stability

Blue-Collar Workers. All 50 EEI four-profile split pairs met the optimization criterion after numerical recovery. Mean signed centroid correlation was .749 and mean ARI was .516 (2.5th–97.5th percentiles .313–.769). Fifteen partitions triggered a small-profile flag in at least one half, and some matched centroids correlated negatively. These findings indicate appreciable instability despite successful optimization and do not establish four sharply reproducible worker types.

White-Collar Workers. All 50 VII two-profile split pairs qualified. Mean signed centroid correlation was .935, and mean ARI was .707 (2.5th–97.5th percentiles .405–.902), with no half-sample size flags. This solution was more internally stable than the VVI three-profile alternative. Removing the two insecurity indicators in a same-family, same-count sensitivity analysis yielded ARIs of .823 and .875 relative to the 22-indicator blue- and white-collar solutions, respectively.

Profile Description

Blue-Collar Workers (k = 4). Profile means on the 22 indicators are presented in Table 2 and illustrated in Figure 1.

Profile 1: Moderately strained (*n* = 136; 32.1%). Elevated work pace and emotional demands accompanied relatively low recognition, leadership quality, supervisory support, and organizational justice.

Profile 2: Low-demand, resource-rich (*n* = 105; 24.8%). This group had the lowest demand scores and high recognition, predictability, leadership quality, and trust. The label is relative: influence and control over working time were not uniformly high, and job insecurity was the highest among the four profiles.

Profile 3: High-demand, resource-poor (*n* = 31; 7.3%). The smallest group combined the highest demand scores with low recognition, meaning, supervisory support, and justice. Its small size and the split-half results warrant caution about precise prevalence and boundaries.

Profile 4: Moderate mixed (*n* = 152; 35.8%). The largest profile occupied an intermediate position on most demand and resource measures, with comparatively high role clarity.

Table 2

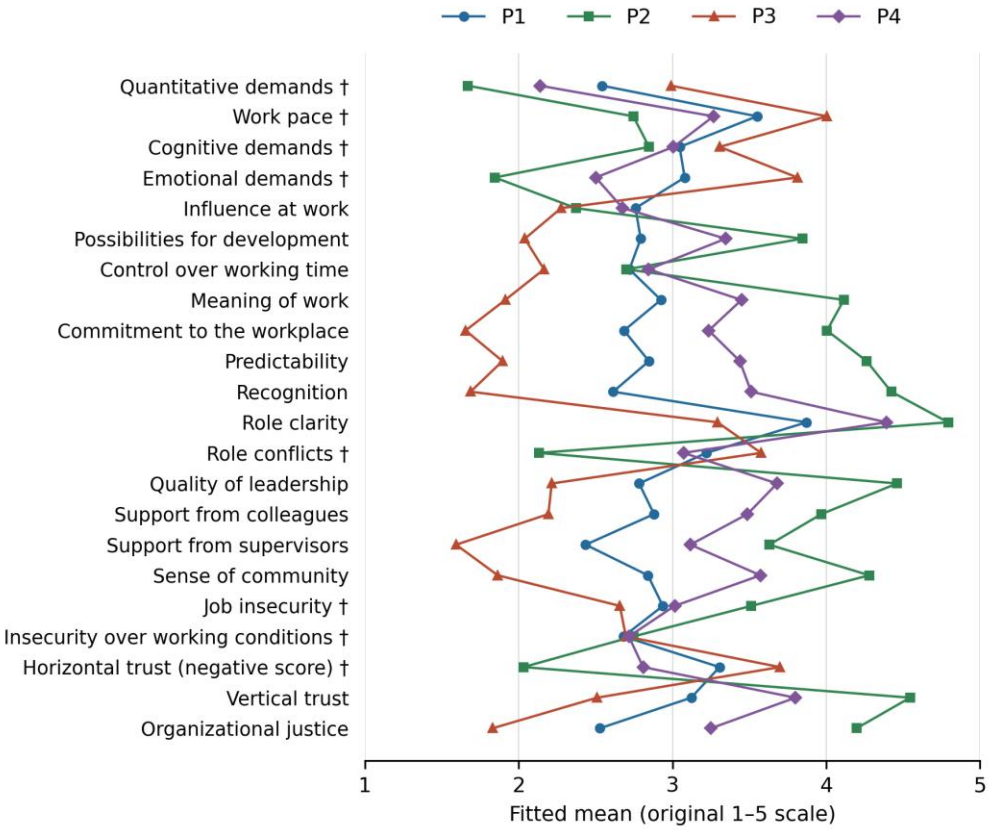
Profile Means on the 22 COPSOQ III Indicators: Blue-Collar Workers (N = 424)

Exposure scale	P1 *n* = 136	P2 *n* = 105	P3 *n* = 31	P4 *n* = 152
Quantitative demands †	2.54	1.67	2.99	2.14
Work pace †	3.55	2.75	4.00	3.27
Cognitive demands †	3.05	2.85	3.31	3.01
Emotional demands †	3.08	1.84	3.81	2.50
Influence at work	2.76	2.37	2.28	2.68
Possibilities for development	2.79	3.84	2.04	3.35
Control over working time	2.72	2.70	2.16	2.84
Meaning of work	2.93	4.12	1.91	3.45
Commitment to the workplace	2.69	4.01	1.65	3.24
Predictability	2.85	4.26	1.89	3.44
Recognition	2.61	4.42	1.69	3.51
Role clarity	3.87	4.79	3.29	4.39
Role conflicts †	3.22	2.13	3.58	3.07
Quality of leadership	2.78	4.46	2.21	3.68
Support from colleagues	2.88	3.97	2.19	3.49
Support from supervisors	2.44	3.63	1.59	3.12
Sense of community	2.84	4.28	1.86	3.57
Job insecurity †	2.94	3.51	2.66	3.01
Insecurity over working conditions †	2.68	2.75	2.70	2.72
Horizontal trust (negative score) †	3.31	2.03	3.70	2.81
Vertical trust	3.12	4.55	2.51	3.80
Organizational justice	2.53	4.20	1.83	3.25

Note. Fitted means in original 1–5 units. Counts use modal assignment. P1 = Moderately strained; P2 = Low-demand, resource-rich; P3 = High-demand, resource-poor; P4 = Moderate mixed. † Higher values denote more adverse exposure; higher values on the other scales denote more favorable conditions. Horizontal trust retains the negative orientation of the supplied score.

Figure 1

Psychosocial Exposure Profiles Among Blue-Collar Workers (N = 424)



Note. Fitted means in original 1–5 units, without reversing any indicator. † Higher values denote more adverse exposure; higher values on other indicators denote more favorable conditions. Profile labels and sizes appear in Table 2. Connecting lines guide the eye across distinct scales.

White-Collar Workers (k = 2). Profile means are shown in Table 3 and Figure 2.

Profile 1: Cognitively demanding, resourced (n = 133; 53.6%). Cognitive demands were elevated (3.74), alongside comparatively high development opportunities, meaning, recognition, role clarity, and community. This profile also reported lower insecurity and a more favorable horizontal-trust score.

Profile 2: Higher-demand, fewer resources (n = 115; 46.4%). All demand indicators were higher and resource indicators lower than in P1. Cognitive demands were high in both groups (3.95 in P2), while differences were larger for predictability, recognition, leadership, supervisory support, and justice. This label describes relative exposure rather than a clinical threshold.

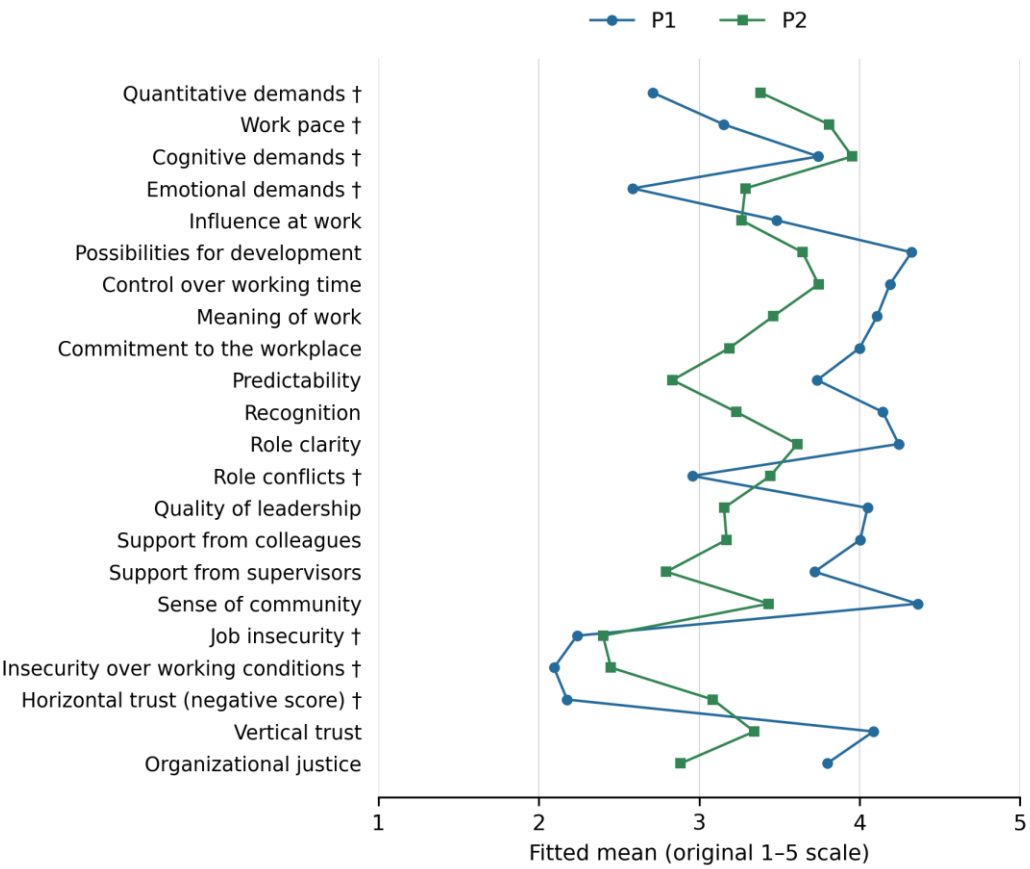
Table 3

Profile Means on the 22 COPSOQ III Indicators: White-Collar Workers (N = 248)

Exposure scale	P1 *n* = 133	P2 *n* = 115
Quantitative demands †	2.71	3.38
Work pace †	3.15	3.81
Cognitive demands †	3.74	3.95
Emotional demands †	2.59	3.29
Influence at work	3.48	3.26
Possibilities for development	4.32	3.64
Control over working time	4.19	3.74
Meaning of work	4.11	3.46
Commitment to the workplace	4.00	3.19
Predictability	3.74	2.83
Recognition	4.15	3.23
Role clarity	4.24	3.61
Role conflicts †	2.96	3.44
Quality of leadership	4.05	3.16
Support from colleagues	4.00	3.17
Support from supervisors	3.72	2.79
Sense of community	4.36	3.43
Job insecurity †	2.24	2.40
Insecurity over working conditions †	2.09	2.45
Horizontal trust (negative score) †	2.18	3.09
Vertical trust	4.09	3.34
Organizational justice	3.80	2.88

Note. Fitted means in original 1–5 units. Counts use modal assignment. P1 = Cognitively demanding, resourced; P2 = Higher-demand, fewer resources. † Higher values denote more adverse exposure; higher values on other scales denote more favorable conditions. Horizontal trust retains the negative orientation of the supplied score.

Figure 2
Psychosocial Exposure Profiles Among White-Collar Workers (N = 248)



Note. Fitted means in original 1–5 units, without reversing any indicator. † Higher values denote more adverse exposure; higher values on other indicators denote more favorable conditions. Profile labels and sizes appear in Table 3. Connecting lines guide the eye across distinct scales.

Exploratory Sociodemographic Associations

Classification-corrected regression estimates and numerical diagnostics are supplied in the supplement. These analyses are secondary to the exposure profiles and distal-outcome comparisons.

Blue-Collar Workers. Only 370 of 499 regression bootstrap replicates qualified (74.1%), below the operational 95% threshold. Consequently, the point estimates are descriptive and no bootstrap confidence intervals or p-values are interpreted. The available results do not support a firm conclusion about tenure, age, sex, or education as predictors of blue-collar profile membership.

White-Collar Workers. For white-collar workers, 491/499 replicates qualified (98.4%). None of the six covariate contrasts met the .05 threshold after Holm adjustment. For example, the odds ratio for age 40 or older versus up to 29 was 2.47 (unadjusted 95% CI [0.99, 6.42]; adjusted p = .368), comparing P2 with P1. The interval is wide; these findings do not establish equivalence or absence of sociodemographic differences.

Well-Being Outcomes by Profile

BCH outcome analyses qualified in 490/499 blue-collar and 491/499 white-collar bootstrap samples. Omnibus differences were detected for all seven COPSOQ outcomes in both strata (Holm-adjusted $p < .001$). Table 4 reports corrected means and percentile intervals. Full pairwise contrasts are supplementary.

Blue-Collar Workers. The high-demand, resource-poor profile (P3) had the highest burnout, stress, sleeping troubles, depressive symptoms, and work-life conflict, the poorest self-rated health (3.57), and the lowest satisfaction. The low-demand, resource-rich profile (P2) showed the opposite ordering on all seven measures, including the most favorable self-rated health (2.31). P1 and P4 occupied intermediate positions on every outcome.

White-Collar Workers. P2 reported more symptoms and work-life conflict, poorer self-rated health (3.03 versus 2.45), and less satisfaction than P1. All seven P1–P2 contrasts remained significant after Holm adjustment.

Table 4

Classification-Corrected Distal Outcomes by Profile

Outcome	P1	P2	P3	P4
Blue-collar workers (*N* = 424)				
Burnout	3.48 [3.16, 3.68]	2.27 [1.78, 2.48]	4.11 [3.51, 4.73]	2.95 [2.54, 3.18]
Stress	3.18 [2.84, 3.45]	2.12 [1.52, 2.31]	3.82 [3.24, 4.21]	2.68 [2.42, 2.94]
Sleeping troubles	3.02 [2.73, 3.23]	2.23 [1.77, 2.42]	3.64 [2.97, 4.35]	2.56 [2.29, 2.80]
Depressive symptoms	2.94 [2.65, 3.22]	1.91 [1.40, 2.08]	3.67 [3.05, 4.17]	2.49 [2.17, 2.68]
Self-rated health	3.13 [2.89, 3.33]	2.31 [1.95, 2.50]	3.57 [3.03, 4.17]	2.76 [2.36, 2.95]
Job satisfaction	2.74 [2.41, 3.18]	3.97 [3.78, 4.29]	1.94 [1.55, 2.46]	3.32 [3.15, 3.87]
Work-life conflict	2.70 [2.41, 2.90]	1.67 [1.40, 1.83]	3.79 [2.88, 4.65]	2.27 [1.91, 2.53]
Any absence	0.50 [0.39, 0.60]	0.41 [0.26, 0.50]	0.45 [0.17, 0.62]	0.45 [0.37, 0.57]
White-collar workers (*N* = 248)				
Burnout	2.61 [2.42, 2.76]	3.36 [3.21, 3.60]	—	—
Stress	2.48 [2.31, 2.63]	3.23 [3.06, 3.47]	—	—
Sleeping troubles	2.38 [2.17, 2.55]	3.05 [2.88, 3.27]	—	—
Depressive symptoms	2.08 [1.91, 2.23]	2.91 [2.73, 3.16]	—	—
Self-rated health	2.45 [2.29, 2.58]	3.03 [2.89, 3.24]	—	—
Job satisfaction	3.87 [3.75, 3.98]	2.97 [2.79, 3.16]	—	—
Work-life conflict	2.55 [2.33, 2.70]	3.13 [2.99, 3.35]	—	—
Any absence	0.22 [0.15, 0.31]	0.32 [0.23, 0.40]	—	—

Note. Values are BCH means [unadjusted percentile 95% CI], except any absence, shown as probabilities. Higher satisfaction scores are favorable; higher symptom, conflict, and self-rated health scores (1 = excellent, 5 = poor) are adverse. All seven scale omnibus tests had Holm-adjusted $p < .001$; adjusted p for any absence was .815 (blue-collar) and .144 (white-collar). Intervals use 490 and 491 qualified bootstrap replicates, respectively, and condition on the selected profile model. — = not applicable.

Absenteeism

Corrected probabilities of any absence were .50, .41, .45, and .45 across blue-collar P1–P4, and .22 and .32 across white-collar P1–P2. Neither omnibus comparison met the adjusted .05 threshold (p = .815 and .144, respectively). The five-category BCH table contained negative estimates in two rare categories of blue-collar P3; these were neither truncated nor interpreted as valid probabilities. The supplement retains the diagnostic estimates and modal category counts for descriptive use.

Discussion

This study described psychosocial exposure heterogeneity within two occupational groups in a manufacturing company. Four blue-collar and two white-collar profiles were retained as exploratory working solutions. Higher-demand, lower-resource configurations accompanied more burnout, stress, sleeping troubles, depressive symptoms, and work-life conflict, poorer self-rated health, and lower satisfaction. Absenteeism and sociodemographic analyses provided no clear additional differentiation. The contribution is a description of within-occupation patterns and their concurrent correlates, with explicit uncertainty about profile enumeration.

The co-occurrence of demands and resources is compatible with demand-control-support, JD-R, and resource-caravan accounts (Bakker et al., 2023; Hobfoll, 2011; Johnson & Hall, 1988). Similar combinations have been described in Portuguese occupational samples and Italian healthcare workers (Gameiro et al., 2020; Portoghese et al., 2020, 2025). However, the present profiles also largely follow gradients of exposure and resources. They do not reproduce all theoretical quadrants, establish interactions, or demonstrate resource-loss spirals. Correlations among COPSOQ scales and the imposed diagonal mixture structures may contribute to the extracted configurations.

Blue-collar P3 illustrates a particularly adverse combination of demands, recognition, supervisory support, and justice. This pattern resembles iso-strain, but interpreting it as a demonstrated mechanism would exceed the design. The profile contains 31 workers, and half-sample instability cautions against treating its boundaries or estimated prevalence as fixed. Blue-collar P2 also prevents an overly simple protective/adverse dichotomy: its favorable demand and resource pattern coexists with relatively high job insecurity and modest influence and working-time control.

In the white-collar stratum, both profiles reported elevated cognitive demands. Differences in quantitative and emotional demands, leadership, predictability, and support accompanied the resource gradient. This is consistent with the relevance of organizational resources in demanding work, but the two-profile solution is constrained by its spherical covariance structure. Its higher stability supports its use as a concise description of this sample, rather than proof that white-collar work has exactly two underlying types.

Self-rated health followed the same gradient as the symptom measures in both strata: workers in the more adversely exposed profiles rated their general health as poorer. Self-rated health is a single global item that did not enter profile estimation, so its agreement with the multi-item symptom scales extends the outcome pattern beyond specific symptoms. All outcomes, however, were

reported on the same occasion as the exposures, and this convergence describes concurrent association.

The corrected regression analyses do not sustain a substantive account of tenure or age effects. In blue-collar workers, the low proportion of qualified bootstrap estimates prevents reliable inference; in white-collar workers, adjusted tests were inconclusive and intervals broad. These results should not be interpreted as evidence that demographic inequalities are absent or that organizational conditions affect all groups equally. Prospective research on psychosocial exposures has documented demographic variation in health associations (Niedhammer, Derouet-Gérault, & Bertrais, 2022), which is a different question from profile membership in one firm.

The observed heterogeneity argues for examining working conditions within occupational categories rather than using occupational labels alone as exposure proxies. This is compatible with evidence from steel and physically demanding work settings (Metzler & Bellingrath, 2017; Vinstrup et al., 2021). Nevertheless, fitting separate models with different covariance assumptions and profile counts does not establish structural differences between groups. Comparing pooled and stratified solutions and testing measurement invariance would be required to determine whether these patterns reflect structural differences between occupational groups.

Limitations

The cross-sectional, single-company design limits causal interpretation and generalizability. Concurrent self-reports can share method variance, and selection into continued employment may affect the observed distributions (Arrighi & Hertz-Picciotto, 1994). Scale means are bounded and correlated, whereas the fitted mixtures assume Gaussian indicators and zero within-profile covariances. Blue-collar stability was moderate, several alternatives fitted better by BIC, and incomplete BLRT qualification limits enumeration claims. Bootstrap intervals condition on successful fits and the selected model, omitting selection uncertainty; differential failures may affect their coverage. Finally, imprecise absence and regression results limit external corroboration.

Implications

For this organization, the profiles can guide participatory discussion of workload, recognition, supervisory support, and organizational justice, alongside insecurity and control over working time. They should not be used to diagnose individual workers or assign interventions solely by profile membership. Organizational assessment and worker consultation are needed to translate these descriptive patterns into priorities, and prospective evaluation would be required to establish intervention benefits. Stratification is useful here for describing within-group variation; it is not presented as universally superior to pooled or multigroup modeling.

Conclusion

Exposure-defined profiles identified meaningful within-occupation heterogeneity and concurrent differences in all seven well-being outcomes, with poorer outcomes in configurations that combined higher demands and fewer resources. Four blue-collar and two white-collar profiles provide provisional summaries of this sample, with stronger internal stability for the latter. The results support further attention to combinations of working conditions, while the precise number of profiles, causal mechanisms, and generalizability remain open questions.

Data and Code Availability

The de-identified analytic scale scores, R scripts, frozen model-selection inputs, numerical diagnostics, and completed outputs are provided in the supplementary reproducibility package. Tables and figures can be rebuilt from saved results without refitting models.

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