Pain, Conflicted Feelings About Work, and Sickness Absence: A Prospective Study of the Effects of Number of Pain Sites and Role Conflicts on Medically Certified Sickness Absence

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Abstract: We investigated associations between the number of pain sites (NPS) and role conflict with medically certified, pain-related sickness absence (SA) in employees of Norwegian enterprises (N = 5,654). Latent profile analyses identified exposure profiles based on 3 types of role conflict (work-role conflict, work-life conflict, and emotional dissonance). Multinomial logistic regressions estimated effects on absence (short-term absence of less than 56 days, long-term absence of more than 56 days) during 1 year after survey. Effects of the NPS on absence were compared across exposure profiles. Results suggested the NPS and all types of role conflict predicted absences separately. Mutually adjusted regressions revealed unique contributions of the NPS to the short-term and long-term absence (odds ratio [OR] 1.24, 95% confidence interval [CI] 1.18, 1.30 and OR 1.51, 95% CI 1.37, 1.66) and of work-role conflict to the short-term absence (OR 1.18, 95% CI 1.03, 1.35). Latent profile analyses identified 4 exposure profiles ("1 unconflicted," "2 dissonant, otherwise medium," "3 conflicted, medium dissonance," "4 conflicted and dissonant"). Profiles 3 and 4 exhibited elevated risk of SA, with the strongest baseline-adjusted effects for profile 4 (short-term absence OR 1.90, 95% CI 1.40, 2.57, long-term absence OR 1.95, 95% CI 1.15, 3.31). Effects of the NPS on short-term absence were stronger for profile 4 versus profile 1 (OR 1.38 vs 1.24, P < .001). Our findings suggest that addressing role conflicts may prevent pain-related absence, possibly also for individuals already experiencing pain.

Perspective: This article elucidates the connections between role conflicts associated with work roles, the NPS, and SA due to pain. This should help organizations prevent pain-related absences from work and improve working conditions for workers who remain occupationally active in spite of pain problems.

Pain complaints are major contributors to sickness absence (SA).[1] The likelihood of pain-related SA, as well as the overall likelihood of future disability and health care utilization, increases with the number of afflicted anatomic sites.[2–5] Haukka et al[6] found that multisite musculoskeletal pain predicted medically certified disability retirement among Finns, and a 2007 study in Sweden observed that concurrent

pain in the lower back and neck/shoulders was associated with a higher risk of SA than either condition alone.[7] Similarly, a study of white-collar workers in Denmark revealed that concurrent pain in the hand/wrist, neck/shoulder, and lower back was associated with a higher risk of SA than each complaint separately.[8] Additionally highlighting the role of co-occurring psychosocial work characteristics, a study in Norway concluded that the risk of musculoskeletal disorder-related SA increased with the number of afflicted anatomic sites as well as with combined high job demands and low job control.[9]

Role conflict is another psychosocial work factor associated with pain.[10,11] Role expectations refer to the behaviors considered appropriate for an occupant of a particular position within a group (eg, employee or employer),[12] and role conflict occurs if different expectations of one role or different roles one individual occupies are incompatible (ie, *intra*-role- and *inter*-role conflict, respectively).[13,14]

Work-role conflict refers to contradictions between or within work roles, for instance, when an employee receives incompatible requests from different managers. Another form of role conflict, which pertains to a clash between expectations from different domains, is *work-life conflict* (WLC). This type of role conflict may be increasingly salient with digitalization and the dissolving of the natural boundaries between work and private life. For instance, evidence shows that telework from home is associated with WLC.[15,16] Another source of conflicted feelings that seems increasingly relevant is *emotional dissonance*.[17] The growing tertiary sector and increased demand for health care with aging populations mean that *emotion work*, that is, tasks requiring handling the emotions of others and displaying certain emotions, is a vital part of many contemporary jobs.[18,19] Emotional dissonance constitutes a *person-role conflict*,[20] as it entails incongruence between the emotional expression a role requires and the emotions actually experienced by the individual in that role.[21] It has been suggested to be the most taxing aspect of emotional labor.[21]

Role conflict may influence pain-related SA by influencing pain. However, working conditions may also influence the likelihood that employees already suffering from pain need SA. The individual's assessment of job demands and work ability determines decisions on the need for sick leave. A work situation characterized by role conflict may amplify the difficulties a worker has adjusting to and performing tasks that would otherwise have been possible to perform despite the pain. Moreover, role conflict predicts psychological distress,[22–24] which may potentiate the adversity of preexisting pain. Social contexts can influence the experience of pain and disability,[25,26] and salient contexts such as the work environment may significantly amplify the threat-signal information of the pain. For instance, catastrophizing and fear of painful consequences of work activities may be heightened, and the motivation and surplus needed to remain vocationally active may be impeded.

In short, there are several reasons to believe that individuals suffering from pain are less likely to remain occupationally active if experiencing role conflict. However, evidence is still scarce, and studies have not examined role conflict, number of pain sites (NPS), and SA in combination. To extend previous knowledge, the present study will address 2 main questions, namely 1) to what extent do NPS and different types and configurations of role conflict influence pain-related SA? and 2) does the relationship between NPS and SA vary with different levels and patterns of role conflict?

Methods

Procedure and Participants

The study was based on data from the research project "The new workplace: work, health, absence, and participation in working life," which is a web-based survey conducted at the National Institute of Occupational Health (NIOH) in Norway. The aim of the project was to comprehensively study work characteristics and work environment to ascertain relationships with health, well-being, work ability, and SA. Recruitment was done at the organizational level, and companies were either contacted by NIOH or contacted NIOH themselves to participate in the study, as information about it was disseminated on NIOH websites and social media. All currently working employees of each company were invited to participate. More details about the project and procedure can be found in the published study protocol.[27]

After general information about study aims was presented at the organizational level, each employee not on sick leave received a letter with comprehensive information about the survey, implications of consent, confidential treatment of responses, ethical considerations, and a personalized code for login to a web questionnaire. A wide variety of sectors and types of jobs from both the private and public sectors were represented in the sample, for example, municipalities, health care, finance, insurance, education, and nonprofit.

As the project pertains to health and human subjects, it was approved by the Regional Committees for Medical and Health Research Ethics and the Norwegian Data Inspectorate, and conducted in accordance with the World Medical Association Declaration of Helsinki. Participation was voluntary and informed consent was obtained from all participants.

A total of 30,945 employees from 96 organizations, working full-time or part-time, were invited over a 10-year period (November 2004 to December 2014) to complete a work environment survey. Altogether 15,302 (49.4% of invited) employees responded. Questions about emotional dissonance were only presented to subjects that first confirmed working with clients, such as customers, kindergarten children, pupils, patients, or other types of clients that require human interaction as a part of the job. Hence, only those who completed these items were included (10,781 employees, 70.5% of those who responded initially). Of these, 7,758 (72%) permitted linking survey data to registry data on SA. Subjects were also excluded if they had no pain-related SA, but at least 1 day of certified SA

that was not due to pain complaints. This was done to ensure that workers with SA due to pain were compared with workers who had no SA, pain-related or not. Regardless of the primary cause given for an episode of absence, pain could contribute to triggering it, and if this pain were influenced by role conflict, including such SA episodes in a comparison group of "no pain-related SA" could constitute misclassification and attenuate effect estimates. Hence, 5,972 participants (39% of all respondents) were included, and after the exclusion of subjects with missing data, the final effective sample consisted of 5,654 employees (37% of all initial respondents).

Dependent Variable Medically Certified SA Due to Pain

Official registry data were obtained from the Norwegian Labor and Welfare Administration, providing registrations of all medically certified SA in the Norwegian welfare system, including the number of days absent and the medical diagnosis given as the reason for absence. In Norway, employees have the right to a minimum of 3 consecutive self-certified days of SA up to 4 times a year before certification from a physician is required. Many companies have extended these numbers, though, and it is not uncommon to allow 8 consecutive days for up to 24 days during a calendar year. It should be noted that SA may also be medically certified from any day of illness, irrespective of self-certification allowances. The present data only reflect medically certified SA, and the number of days of self-certified sick days, if any, is unknown. Medical certification registrations are required in order to receive payments from the national social insurance scheme for absences that last longer than 16 days. For the present study, the number of days of medically certified SA was counted during 12 months following the work environment survey. Hence, the variable reflected the number of days of SA during the year following the completion of the survey.

In Norway, all medically certified SA is classified by diagnosis in accordance with the International Classification of Primary Care-2.[28] This classification was used to identify absences attributed to pain complaints. We were interested in absence due to symptoms/complaints, that is, pain without a specific cause in one or more locations. That is, SA days were not counted if they were due to specific diagnoses attributed to innate or communicable diseases or accidents and injuries, such as congenital heart disease, bone fractures, infections, or cancer.

Consistent with a previous literature study conducted by the Norwegian Institute of Public Health, commissioned by the Directorate of Labor and Welfare,[29] long-term and/or frequent SA (in the following referred to as long-term sickness absence [LTSA]) was defined as at least 8 weeks, that is, 56 days, of absence, either consecutively or distributed over several occurrences, throughout the year following the survey. Consequently, short-term sickness absence (STSA) is defined as an absence of less than 8 weeks.

Independent Variables

The NPS was measured by dichotomizing and summing up 8 different pain complaints, namely pain in the neck, shoulders, upper arm, back, legs, underarms/wrists/hands, chest, and gastrointestinal pain. The resulting outcome variable thus ranged from 0 – no pain to 8 – pain in all measured anatomic sites. The pain complaints were measured by presenting the subjects to a symptom checklist (previously used in eg[10,30,31]) where each complaint was asked about in the following way (exemplified here for neck pain) "during the previous four weeks, have you been troubled by neck pain?", with the response categories "1 Not troubled," "2 A little troubled," "3 Somewhat troubled," "4 Severely troubled." The variables were dichotomized to distinguish between "Not troubled," that is, no pain, and "A little troubled" or more, that is, some degree of pain. Although the wording "troubled by" may seem to refer to the psychological or functional consequences of pain, it is a common phrasing in Norwegian to indicate the presence of pain (in the same way that "complaint" indicates the presence of pain rather than complaining).

Role factors were operationalized by 3 distinct concepts that reflect conflicts of demands attached to roles: Work-role conflict, WLC, and emotional dissonance.

Work-role conflict and WLC were operationalized by 6 questionnaire items from the General Nordic Questionnaire (QPS$_{Nordic}$) for Psychological and Social Factors at Work, a questionnaire instrument that has demonstrated good psychometric properties in several previous studies.[32,33] Work-role conflict was measured by 3 items from the role conflict scale of QPS: "Do you have to do things that you feel should be done differently?", "Are you given assignments without adequate resources to complete them?", "Do you receive incompatible requests from two or more people?", as well as 1 additional single item, also included in the QPS "Does your job involve tasks that are in conflict with your personal values?". Work-private life conflict was operationalized by 2 items "Do the demands of your work interfere with your home and family life?" and "Do the demands of your family or spouse/partner interfere with your work-related activities?". These items were rated on a 5-point Likert scale reflecting the frequency of occurrence "1 Very seldom or never," "2 Fairly seldom," "3 Sometimes," "4 Fairly often," and "5 Very often or always."

Emotional dissonance was operationalized by 4 items adapted from the Frankfurt Emotion Work Scale[17] "How often in your job do you have to suppress feelings in order to appear neutral 'on the outside'?", "How often in your job do you have to express feelings towards clients/customers that are not in accordance with what you actually feel towards them in that specific situation?", "how often in your job do you have to display a positive mood/be agreeable or display unpleasant feelings (eg, anger) while you are actually indifferent to the situation?", "how often in your job do you have to display feelings that are not in accordance with your actual feelings?". These items were rated on a 5-point frequency scale "1 Rarely or never," "2

Once a week," "3 Once a day," "4 Several times a day," "5 Several times an hour."

Covariates

Gender, skill level, age at the time of the survey, and the number of days of SA during the year leading up to the survey were entered as covariates. Skill level was defined according to the classifications of occupations reported by the companies for each employee. These classifications are a Norwegian adaptation of the International Standard Classification of Occupations (ISCO-88), classifying jobs to reflect the tasks and duties they typically involve. Educational level or equivalent working experience required for the job is reflected by the ISCO88, based on the International Standard Classification of Education, and these skill level categories reflect occupations that normally require first or postgraduate university degree or college exams of similar level (ie, more than 16 years of education), 1 to 3 years of college/university education (13–15 years), 1 to 3 years of secondary education (10–12 years), primary education (less than 9 years), or unspecified competence level (ie, occupations with no specific formal education requirements).

Statistical Analyses

Statistical analyses were run using R version 4.2.2[34] and MPLUS version 8.7.[35] A criterion of statistical significance of $P < .05$ was set.

In order to establish the overall relationship of the different factors (ie, NPS, role conflict, work-private life conflict, and emotional dissonance) with certified SA during the year after the survey, multinomial logistic regressions were run. For these regressions, the role conflict factors were computed as the mean of their corresponding items. Hence, odds ratios (ORs) and 95% confidence intervals (95% CIs) for the ORs were calculated to express the effect of NPS and role factors separately and mutually adjusted on the risk of STSA and LTSA, compared with no SA, during the year after the survey. These analyses were adjusted for days of SA during the previous year, age, sex, and skill levels.

To classify exposures based on the ten role factor items, latent profile analyses (LPA)[36] were employed to obtain "natural" profiles of work-role expectations, by classifying employees based on the similarity of combinations of the levels of the 10 measured items. LPA are considered "person-centered," since they identify and characterize groups of individuals based on their distinctive patterns of variable levels,[37] as opposed to "variable-centered" approaches, which describe relationships between variables. Person-centered approaches maintain a "system view" since patterns of components are considered as a whole rather than focusing on 1 variable at a time.[37] As LPA is used to discover and describe "naturally occurring" patterns in a sample, the prediction of distal outcomes (in this case, SA) from such categories can be thought of as representing a more "typical" exposure-outcome relationship than would be the result of the more variable-centered approaches. Hence, LPA can address specific research questions about the consequences of exposure as well as broadening theoretical thinking about the existence of different configurations of exposure in practice. One limitation of variable-centered approaches can be that the typical, "real-life" implications of work factors that, in practice, tend to appear in clusters may be obscured when they are studied separately or mutually adjusted. In other words, the purpose of LPA in the present analyses was to examine typical clusters of exposure in the world of work, and the implications of these on the outcome and the NPS-SA relationship.

LPA is a type of mixture model, more specifically, a latent class analysis where indicator variables are specified as continuous. An unordered categorical latent variable, also known as a latent class variable, is used to capture and describe underlying patterns in observed data without a priori classifications. The categorical latent variable is unobserved but inferred from data to account for differences between groups— that is, classes—of subjects that are more similar within than between classes. Hence, the model is specified to minimize covariance of items within groups so that variance is rather explained by differences between groups (called the condition of local independence).[38]

Since the number of profiles is not known a priori, LPA starts with running a series of models with an increasing number of profiles, comparing how the different models fit data to determine the most appropriate number of profiles ("profile enumeration"). The appropriate number of profiles was determined by judging a number of fit indices reflecting the fit of the estimated models the Bayesian Information Criterion (BIC), Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR), and the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR).[39,40] Smaller BIC and P-values of less than .05 for the likelihood ratio tests support the notion that a mixture of k classes fits better than a mixture of k-1 classes. Thus, based on statistical criteria alone, the enumeration process should stop when the BIC stops decreasing and/or the VLMR and LMR tests become nonsignificant. However, statistical tests aid the process of enumeration, but the final judgment relies on the analyst's judgment of interpretability, utility, and parsimony of the profile groups.[38,39] For example, very small or very similar profile groups may not add useful information.

After deciding on the number of latent profiles, models were estimated to determine the relationships of the latent profiles with SA. Hence, the 3-category SA variable was regressed on the latent profiles as well as sex, age, skill level, and the number of days SA 1 year prior to the survey. These models were specified using a manual 3-step approach according to the procedure described by Asparouhov and Muthén.[41] When using a 1-step method, the regressions of latent profiles on covariates and of the outcome on latent profiles contribute information to the profile formation. Hence, to maintain the conceptual distinction between SA and role conflict profiles, we utilized a 3-step approach, which ensures that the latent profile variable is not affected by the inclusion of predictors and outcomes.
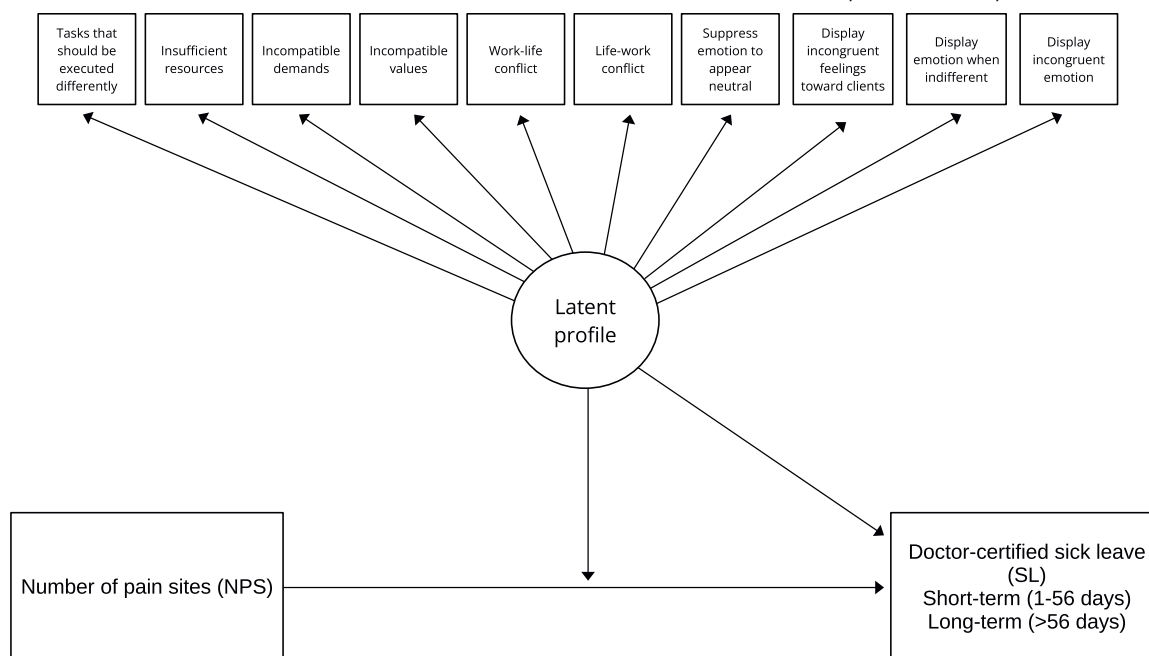
Figure 1. Conceptual model. The categorical latent variable defines latent profiles of role expectation items, allowing the associations of NPS with occurrence of STSA and LTSA to vary between latent profiles.

Thus, the parameters of the latent profile variable of the conditional model (ie, with SA and covariates added) were fixed at values from the unconditional model (ie, with only the latent profile variable). Hence, the 3 modeling steps consist of 1) estimating the unconditional model that determines the latent profiles (ie, class enumeration), 2) assigning individuals to latent profiles, and 3) estimating the final model with measurement parameters for the latent profiles fixed at values that incorporate measurement error in the profile assignment. The third step accounts for the uncertainty of assigning individuals to profiles that they have a certain probability of actually belonging to, hence the profiles are latent as opposed to observed.

Associations between latent profiles and subsequent SA were estimated with multinomial logistic regressions, comparing STSA and LTSA with no SA during the year following the survey. All regressions were adjusted for age, skill level, sex, and the number of days of SA during the year before the survey.

Finally, to determine whether role factors influenced the impact of NPS on SA, models were estimated where the relationship between NPS and SA was allowed to vary across latent profile groups (see Fig 1). Wald chi-square tests were employed to statistically test the difference between parameters, in this case ORs, between latent profile groups.

Since analyses were based on subjects clustered in work units, and work unit means of job control measures were used, all analyses were adjusted for possible biasing effects of correlated responses within units, by employing a robust maximum likelihood sandwich estimator.[42]

There are divergent opinions on whether one should include previous SA data in analyses of future SA.[43] When not adjusting for a previous absence, the results will show the risk of having had an absence during the study period. When adjusting for SA history, the focus of the analyses will be changes in SA, and a potential consequence of adjustment for previous SA is an underestimation of the true effect of work factors. The current study ran regressions both with and without adjustment for a prior number of days of SA. Baseline adjustment can partial out cross-sectional associations between the independent and dependent variables that occur at baseline and are due to, for instance, reverse causation or reporting biases. However, it may also partial out associations that are relevant to the research question, for instance, substantive effects of independent variables on dependent variables at or prior to baseline.[44]

Results

Descriptives for the analytic sample are given in Table 1.

Since the analytic sample was derived by exclusion of subjects that had participated in the overall survey, some differences were observed between the initial and the final sample regarding demographics. Namely, the initial sample mean age was 42.7 (standard deviation 10.8) versus 42.9 (standard deviation 10.7) for the final sample, and the proportion of females was lower in the final sample (52% vs 55.9%). Moreover, some differences were observed for different skill level categories (numbers for initial vs final analytic sample more than 15 years: 29.1% vs 26.8%; 13–15 years: 27.6% vs 26.6%; 10–12 years: 31.8% vs 34.7%; less than 10 years: 1% vs .5%; managers/unspecified: 10.5% vs 11.4%). Further analyses were conducted to determine the statistical significance of these differences. A multivariable logistic

Table 1. **Sample Characteristics (N = 5,654)**

VARIABLE	VALUE	N	PERCENTAGE (%)	MEAN (STANDARD DEVIATION)
Gender	Male	2,715	48.0	
	Female	2,939	52.0	
Age				42.9 (10.7)
Skill level	> 15 years	1,513	26.8	
	13 to 15 years	1,502	26.6	
	10 to 12 years	1,964	34.7	
	< 10 years	31	.5	
	Managers and unspecified	644	11.4	
Work-role conflict				2.55 (.79)
Work-life conflict				2 (.8)
Emotional dissonance				2.2 (1.1)
Number of pain sites	0	884	15.6	
	1	984	17.4	
	2	1,055	18.7	
	3	1,023	18.1	
	4	756	13.4	
	5	538	9.5	
	6	266	4.7	
	7	117	2.1	
	8	31	.5	
Sickness absence during the year after the survey	No sickness absence	4,816	85.2	
	Sickness absence < 56 days	607	10.7	
	Sickness absence > 56 days	231	4.1	

regression was run with the outcome variable defined as being excluded from the initial sample. These analyses revealed that female gender (OR 1.24, 95% CI 1.15, 1.32) and the lowest skill level, less than 10 years (OR 2.00, 95% CI 1.35, 3.05, compared with skill level more than 15 years), were associated with higher likelihood of being excluded. Two skill level categories exhibited lower odds of exclusion compared with more than 15 years (10–12 years OR .74, 95% CI .68, .81 and managers and unspecified OR .80, 95% CI .70, .90).

The Association of NPS and Role Conflict With SA

Table 2 shows statistically significant associations between the NPS and the 1-year risk of subsequent pain-related SA, for both STSA (OR 1.32, 95% CI 1.26, 1.38) and LTSA (OR 1.66, 95% CI 1.55, 1.78). Statistical significance remained in adjusted models with all covariates, including role factors and previous SA (OR 1.24, 95% CI 1.18, 1.30 and OR 1.51, 95% CI 1.37, 1.66 for STSA and LTSA, respectively).

Table 2. **Results From Multinomial Logistic Regressions Estimating Effects of NPS, Work-Role Conflict, Work-Life Conflict, and Emotional Dissonance on Subsequent Medically Certified STSA (Less Than 56 Days) or LTSA (More Than 56 Days) During the Year Following the Survey, Compared to Having no Medically Certified SA**

	SEPARATE EFFECTS[†] OR (95% CI)	FULLY ADJUSTED[‡] OR (95% CI)
Sickness absence of 1 to 56 days		
Number of pain sites (0–8)	1.32 (1.26, 1.38)*	1.24 (1.18, 1.30)*
Work-role conflict	1.39 (1.24, 1.54)*	1.18 (1.03, 1.35)**
Work-life conflict	1.13 (1.01, 1.26)**	.95 (.83, 1.08)ns
Emotional dissonance	1.23 (1.13, 1.33)*	1.07 [.97, 1.18)ns
Sickness absence of > 56 days		
Number of pain sites (0–8)	1.66 (1.55, 1.78)*	1.51 (1.37, 1.66)*
Work-role conflict	1.37 (1.15, 1.62)*	1.04 (.82, 1.32)ns
Work-life conflict	1.31 (1.10, 1.57)*	1.01 (.79, 1.29)ns
Emotional dissonance	1.16 (1.02, 1.32)**	.98 (.83, 1.17)ns

Abbreviation: ns, nonsignificant.
*P < .01.
**P < .05.
†Separate effects were estimated and adjusted for age, gender, and skill level.
‡Fully adjusted models included NPS and role factors simultaneously, as well as age, gender, skill level, and number of days of sickness absence during the year prior to the survey.

Table 3. Model Fit Estimates for the Latent Profile Analyses With an Increasing Number of Profiles

NO. OF PROFILES	BIC	VLMR P-VALUE	LMR P-VALUE	ENTROPY
1	166,010.6	NA	NA	NA
2	151,715.0	.000	.000	.927
3	148,023.4	.000	.000	.881
4	146,555.5	.001	.001	.806
5	145,150.7	.266	.270	.811

For role factors, statistically significant effects were observed for all 3 factors in unadjusted models on both STSA and LTSA (ORs ranging from 1.13, 95% CI 1.01, 1.25 for WLC on short-term absences to 1.39, 95% CI 1.24, 1.54 for work-role conflict on STSA). Most of these effects did not remain statistically significant when mutually adjusted for each other and the NPS, age, gender, and previous SA. However, the effect of work-role conflict on STSA did remain statistically significant (OR 1.18, 95% CI 1.03, 1.35).

Latent Profile Analyses
Profile Enumeration

With regard to the class enumeration procedure, the BIC value continued to decline for all tested solutions (ie, all models with additional latent profiles specified), while the VLMR and LMR tests became nonsignificant for 5 profiles (Table 3). After additionally visually inspecting the plotted items means for each profile to ensure interpretable differences between them (see Fig 2), the 4-class solution was chosen for further analyses.

Table 4 shows the means of the various indicators for each class, and Fig 2 shows these values plotted. Profile 1 was designated "unconflicted" since the levels of all items were lower than for all the remaining groups, that is, the levels of each type of role conflict were relatively low. Profile 2 was designated "dissonant, otherwise medium," since, in relation to the other profiles, levels of emotional dissonance items were high, particularly for "suppressing emotions" and "expressing inauthentic emotions." For this profile, the levels of work-role conflict and WLC were in the medium range compared to the other groups. Profile 3 was
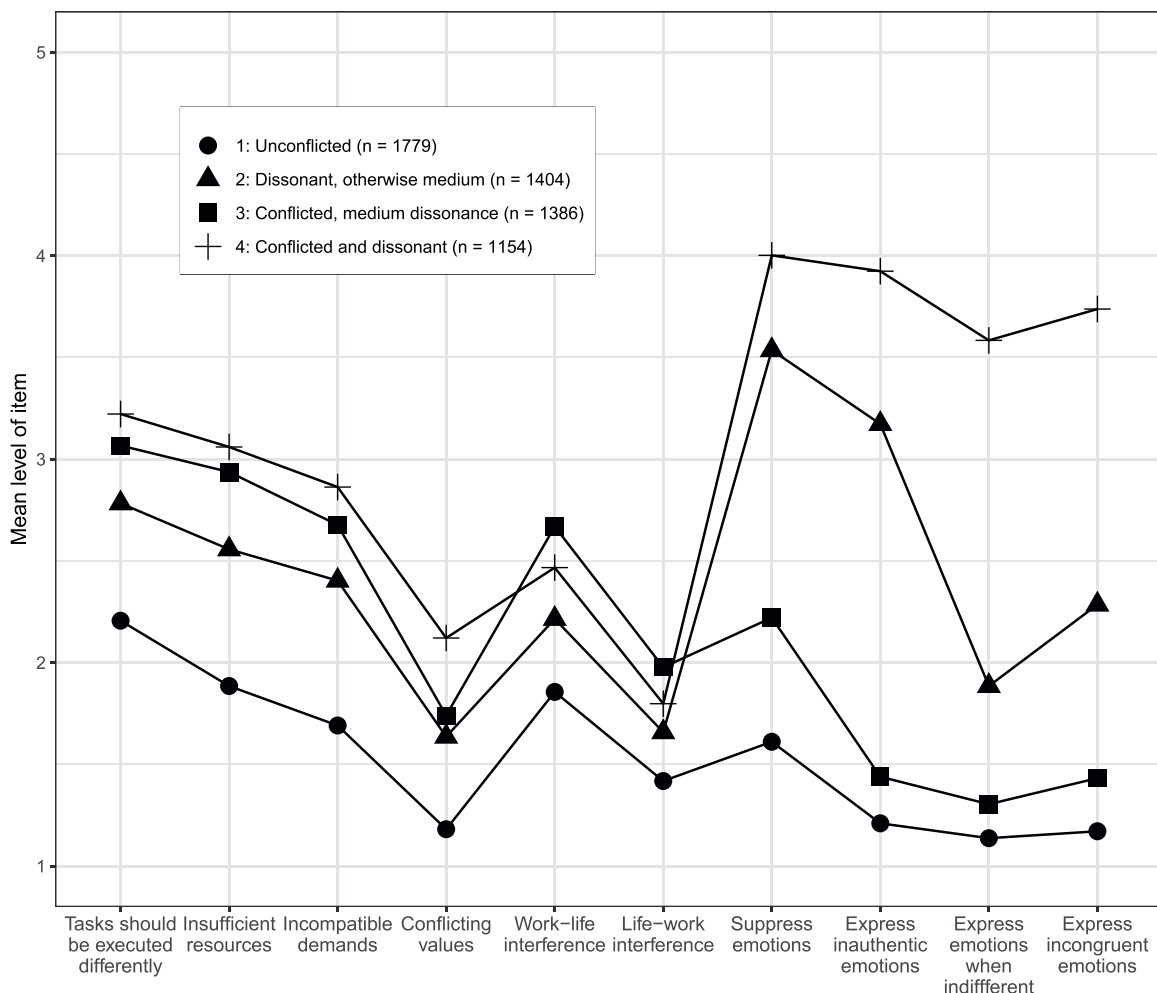

Figure 2. Mean levels of each role factor item, plotted separately for the latent profiles.

Table 4. Mean Levels of Each Role Factor Item by Latent Profile Group

ITEM	UNCONFLICTED (N = 1,779)	HIGH DISSONANCE, OTHERWISE MEDIUM (N = 1,404)	CONFLICTED, MEDIUM DISSONANCE (N = 1,386)	CONFLICTED AND DISSONANT (N = 1,154)
Tasks that should be executed differently	2.18	2.78	3.11	3.23
Insufficient resources	1.85	2.55	3.00	3.07
Incompatible demands	1.66	2.39	2.73	2.88
Incompatible values	1.16	1.62	1.77	2.14
Work-life interference	1.83	2.20	2.72	2.47
Life-work interference	1.40	1.65	2.01	1.80
Suppress emotions	1.59	3.55	2.23	4.01
Express inauthentic emotions	1.20	3.18	1.43	3.93
Express emotions when indifferent	1.13	1.87	1.31	3.60
Express incongruent emotions	1.17	2.28	1.44	3.75

designated "conflicted, medium dissonance," as it exhibited the second highest levels of the work-role conflict items and the highest levels of WLC, but relatively low levels of emotional dissonance (although higher than for the "unconflicted" profile). Finally, profile 4 was designated "conflicted and dissonant" as it exhibited the highest levels of all items except the 2 WLC items. While the profile names reflect the relative positions of the items for the 4 profiles, it should be noted that levels were generally low for the items reflecting work-role conflict and WLC, when considering that all group means were below 3, that is, the midpoint of the scale, for 4 out for 6 items, with the 2 remaining items being close to 3. Also, for work-role conflict in particular, the patterns of items tended to be similar between groups, with the main differences driven by the differences in emotional dissonance.

Effects of Profile Membership on SA

As evident from Table 5, the role conflict profiles were associated with sick leave regardless of SA during the year prior to the survey (ie, in both baseline-adjusted and not baseline-adjusted models).

When compared with profile 1 ("unconflicted"), profiles 3 ("conflicted, medium dissonance") and 4 ("conflicted and dissonant") were associated with elevated risk of both STSA and LTSA due to pain (Table 5). The strongest effects were observed for the latter

profile, "conflicted and dissonant" (baseline-adjusted estimates for short-term absence OR 1.90, 95% CI 1.40, 2.57, and for long-term absence OR 1.95, 95% CI 1.15, 3.31). For nonbaseline-adjusted estimates, the strongest effect was observed for profile 3, "conflicted, medium dissonance" (OR 2.49, 95% CI 1.40, 4.41). It must be noted, however, that CIs were wide and overlapping, and could reflect comparable effects.

For profile 2, "dissonant, otherwise medium," effects on short-term absence were not statistically significant (nonbaseline-adjusted OR 1.31, 95% CI .98, 1.74, baseline-adjusted OR 1.07, 95% CI .77, 1.47). However, the effects on LTSA were significant (nonbaseline-adjusted OR 2.10, 95% CI 1.31, 3.37, baseline-adjusted OR 1.69, 95% CI 1.01, 2.83).

Effects of Profile Membership on the Relationship Between NPS and SA

Table 6 shows the effects of NPS on subsequent SA within each of the profile groups. The associations were statistically significant for all profiles and seemed to vary in strength to some extent. However, only 1 statistically significant difference between effects was observed, for the difference between effects on short-term absence for profile 1, "unconflicted," and profile 4, "conflicted and dissonant"—the ORs of 1.24 and 1.38, respectively, were found to be statistically significantly different with a P-value of less than .01.

Table 5. Estimates From Multinomial Regressions of Effects of Latent Profile Groups on Medically Certified Pain-related STSA and LTSA, Compared With no SA, During the Year Following the Survey

	NOT BASELINE-ADJUSTED		BASELINE-ADJUSTED	
	STSA	LTSA	STSA	LTSA
PROFILE	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
1: Unconflicted	Ref	Ref	Ref	Ref
2: Dissonant, otherwise medium	1.31 (.98, 1.74)[ns]	2.10 (1.31, 3.37)[*]	1.07 (.77, 1.47)[ns]	1.69 (1.01, 2.83)[**]
3: Conflicted, medium dissonance	1.74 (1.23, 2.47)[*]	2.49 (1.40, 4.41)[*]	1.52 (1.03, 2.22)[**]	1.92 (1.03, 3.57)[**]
4: Conflicted and dissonant	2.32 (1.76, 3.06)[*]	2.39 (1.46, 3.93)[*]	1.90 (1.40, 2.57)[*]	1.95 (1.15, 3.31)[**]

Abbreviation: ns, nonsignificant.
NOTE. Odds ratios are adjusted for age, gender, and skill level, and baseline-adjusted estimates are additionally adjusted for the number of days of SA during the year prior to the survey.
[*]P < .01.
[**]P < .05.

Table 6. Effect Estimates for the Association of NPS With STSA (1–56 Days) and LTSA (More Than 56 Days) by Latent Profiles

LATENT PROFILE	EFFECT OF NPS ON SHORT-TERM SICKNESS ABSENCE		EFFECT OF NPS ON LONG-TERM SICKNESS ABSENCE	
	OR (95% CI)	P-VALUE FOR COMPARISON[†]	OR (95% CI)	P-VALUE FOR COMPARISON[†]
1: Unconflicted	1.24 (1.16, 1.34)*	Ref	1.58 (1.43, 1.75)*	Ref
2: Dissonant, otherwise medium	1.28 (1.20, 1.36)*	.41	1.70 (1.55, 1.86)*	.11
3: Conflicted, medium dissonance	1.31 (1.23, 1.40)*	.20	1.67 (1.53, 1.83)*	.32
4: Conflicted and dissonant	1.38 (1.31, 1.45)*	.00	1.65 (1.53, 1.78)*	.35

*$P < .01$.
[†]P-value for Wald chi-square test of the difference between parameters, in this case, odds ratios. Estimates are adjusted for age, gender, and skill level.

Discussion

The present study revealed clear associations of NPS and role conflicts with SAs. The former is perhaps not surprising, since the outcome was pain-related SA. The strong and consistent association of conflicting role expectations with SA represents a more novel insight. Moreover, the results provide nuances and insights about combinations of different aspects of role conflict and their associations with pain-related SA. This knowledge is vital to organizational practice, as role conflicts can be prevented by appropriately designing, organizing, and communicating work content. This suggests the need to carefully analyze and, when necessary, rewrite job descriptions to avoid conflicting expectations. Neglecting this imperative may have significant, costly implications, including higher SA rates. Moreover, a heightened awareness of this may also promote work ability in employees who are vocationally active despite existing pain problems.

Regarding role conflict, previous research has established it as an important contributor to different aversive outcomes.[24,30,45,46] The present results add to this knowledge by confirming that role conflicts, particularly work-role conflicts, predict pain-attributed SA. This is consistent with previous studies showing associations of all-cause LTSA (more than 40 days) with work-role conflict,[47] of WLC with the number of days absent during a 6-month follow-up,[48] of WLC with LTSA (more than 14 days),[49,50] and of both work-role conflict and work-family conflict (measured by the same instruments as in the present study) with self-reported SA (more than 24 days).[51] The conceptualization and measurement of SA (eg, the number of days considered "long-term") varied considerably in these studies, but they seem to have reliably confirmed that SA can be a distal, functional outcome of conflicting demands.

The results also described "natural" profiles of different types of conflicting demands and demonstrated the additional impact of such configurations on SA. Notably, the 4 profile groups were of comparable size, thus the groups associated with risk do not represent marginal phenomena and rare precarious work situations, but rather prevalent exposure combinations. This is a novel approach, but some previous studies have examined latent profiles of role factors. For instance, Lee[52] identified 5 profiles of work-to-life and life-to-work conflict among 823 information technology company employees, indicating, among other things, that 8.6% of the sample

experienced "extremely high WFC" combined with "moderate FWC" while 13.5% experienced "high WFC" with "extremely high FWC." Similarly, Zhang et al[53] identified 3 profiles of combinations of work-family and family-work conflict and -enrichment in a sample of 267 Chinese university counselors. However, we have not found previous studies that combine work-role conflict, work-family conflict, and emotional dissonance, and relate the resulting profiles to SA, or examine their moderating potential. Moreover, most previous studies have employed smaller, more homogenous samples.

The present data do not allow conclusions about why role conflict predicts SA. Nevertheless, several theories may provide insights pertaining to various parts of the process that may be in effect. Broadly speaking, one may distinguish between theories of 1) health-deteriorating processes and 2) decision processes involved in the transition to being on sick leave.

With regard to the health-deteriorating process, the impact of role conflicts can be explained by theories of role strain specifically,[54] and supplemented by numerous theories of organizational stress, such as the Transactional model of stress and coping,[55] the Job Demands Resources model,[56] and the Conservation of resources model.[57] Time, energy and attention are finite resources for any individual. Occupying several roles, experiencing conflicting expectations across them, is likely to deplete such limited resources. Further elucidating the health-deteriorating process, allostatic load theory[58–60] proposes that physiological mechanisms of responding to environmental challenges, like role conflict, taxes health if sustained. Adaptive psychophysiological response patterns involving the autonomic nervous system, hormones, and cytokines that are essential for managing challenge, produce allostatic load and possibly pathology when responses are sustained over time without sufficient restitution.[60] Following this, our findings suggest pain is one health-deteriorating mechanism that can explain how role conflicts can lead to SA.

Although it seems safe to assume that increased NPS represents a burden for most individuals, it is not self-evident that the risk of not being able to work would increase correspondingly for all. Individual differences in responses to the same challenge may arise from pre-existing characteristics of the individual or situation one study showed that workers with pain problems remained able to work when job strain was low.[61] Nevertheless, the

moderating effect of the present profiles was less clear than their association with SA (compare Tables 5 and 6). Possibly, the impact of role conflict on SA stems more from the impact it has on health than the impact it has on work ability or SA decision processes of employees already in pain. However, some difference was observed between the NPS-STSA association of profiles 1 ("unconflicted") and 4 ("conflicted and dissonant"), and comparable albeit nonsignificant differences were observed for LTSA. The notion that preventing role conflicts can contribute to the retention of employees already suffering from pain needs further study.

Most of the differences between the profiles seemed to stem from different mean levels of the various items rather than different patterns (ie, "shapes") of exposure (see Fig 2). Also, most items were below the midpoint of the scales, perhaps indicating relatively favorable working conditions overall. The exception was for the levels of the emotional dissonance items for profiles 3 and 4, suggesting it is relatively common to experience a work situation where one often must suppress authentic and express inauthentic emotions. Interestingly, Table 5 suggests that the added burden of emotional dissonance, which is evident for profile 2 ("dissonant, otherwise medium"), is not sufficient to raise the risk of absence if work-role conflict is relatively low. Although profile 2 exhibits considerably higher levels of dissonance than profile 3 ("conflicted, medium dissonance"), the seemingly moderately higher levels of work-role and work-family conflict of profile 3 seem to drive a higher risk of absence (keeping in mind, however, that these are absolute numbers, and the variance of emotional dissonance was higher than for the other role conflict factors).

Methodological Considerations

Panel studies with discrete measurement occasions are inherently limited by specific timing constraints. Interpretation of results may pertain specifically to the studied time frame and may be more generalizable, depending on whether the follow-up period matches the timing of the transition from being occupationally active to being absent from work. Unknown aspects of this transition could affect results, such as the duration of exposure necessary to elicit SA or the time between sufficient exposure and health effects severe enough to require SA. Affective responses to working conditions can alter appraisals of somatic input more or less immediately since neural regions processing socio-emotional and somatic pain may overlap.[62] On the other hand, and consistent with the allostatic load model, dysregulation of neuroendocrine systems that mediate inflammation could mediate long-term and long-lasting effects.[63] Hence, some health-deteriorating processes operate with a short time lag and others with a long time lag. Additionally, the decision-making process involves the evaluation of whether job requirements remain manageable or not, and this appraisal may in itself represent a stressor. Given the multifactoriality of SA, results from a panel study with discrete measurement occasions must be cautiously interpreted.

Although the sampling procedure was randomized at the individual level since all employees in the organizations were invited, the nonrandom sampling of organizations raises the possibility of selection bias. External validity should be enhanced by the size and diversity of the sample, but sample characteristics should be considered when interpreting results. Moreover, selective response can affect internal validity if participation is a common effect of exposure and health, independently of each other.[64] However, while high response rates are often assumed to improve validity, lower response rates do not automatically imply systematic self-selection. Rather, reasons for nonresponse should be considered.[65] Participants of the present study commonly communicated that the comprehensive questionnaire was time-consuming, and item response rates seemed to reflect respondent fatigue by declining gradually throughout the questionnaire, indicating little specific selection based on item content. However, the response analyses indicated some selection by the inclusion criteria, with women and those with the lowest skill levels being underrepresented in the final sample, possibly due to excluding subjects with SAs if they had no diagnosed pain conditions.

Conclusions

Pain is often resistant to treatment, making it important to elucidate circumstances that prevent it and under which workers with pain can remain vocationally active. The functional outcomes of pain problems may depend on the resources available to meet the challenge, such as the degree of accommodation by employers, or benign psychosocial working conditions that foster the ability to work despite health problems. The present study demonstrated a consistent association of psychosocial working conditions in the form of work-role conflict, work-family conflict, and emotional dissonance, with SA due to pain. Furthermore, preliminary evidence was provided that a work situation characterized by simultaneous high levels of all these aspects of role conflict can contribute to pushing employees with preexisting pain into absences.

Disclosures

Conflict of interest: The authors declare no conflict of interest.

Acknowledgments

References

1. Duchemin T, Bar-Hen A, Lounissi R, Dab W, Hocine MN: Hierarchizing determinants of sick leave insights from a survey on health and well-being at the workplace. J Occup Environ Medicine 61:e340-e347, 2019.

2. Haukka E, Kaila-Kangas L, Ojajärvi A, et al. Pain in multiple sites and sickness absence trajectories a prospective study among Finns. Pain 154:306-312, 2013.

3. Kamaleri Y, Natvig B, Ihlebaek CM, Bruusgaard D: Does the number of musculoskeletal pain sites predict work disability? A 14-year prospective study. Eur J Pain 13:426-430, 2009.

4. Fernandes RCP, de Burdof A: Associations of multisite pain with healthcare utilization, sickness absence and restrictions at work. Int Arch Occup Environ Heal 89:1039-1046, 2016.

5. Hiilamo A, Butterworth P, Shiri R, et al. Within-individual analysis of pain and sickness absence among employees from low and high occupational classes a record linkage study. BMJ Open 9:e026994, 2019.

6. Haukka E, Kaila-Kangas L, Ojajärvi A, et al. Multisite musculoskeletal pain predicts medically certified disability retirement among Finns. Eur J Pain 19:1119-1128, 2015.

7. Nyman T, Grooten WJA, Wiktorin C, Liwing J, Norrman L: Sickness absence and concurrent low back and neck-–shoulder pain results from the MUSIC-Norrtälje study. Eur Spine J 16:631-638, 2007.

8. Andersen LL, Mortensen OS, Hansen JV, Burr H: A prospective cohort study on severe pain as a risk factor for long-term sickness absence in blue-and white-collar workers. Occup Environ Medicine 68:590-592, 2011.

9. Morken T, Riise T, Moen B, et al. Low back pain and widespread pain predict sickness absence among industrial workers. BMC Musculoskelet Disord 4:1-8, 2003.

10. Christensen JO, Knardahl S: Work and Neck pain a prospective study of psychological, social, and mechanical risk factors. Pain 151:162-173, 2010.

11. Taibi Y, Metzler YA, Bellingrath S, Müller A: A systematic overview on the risk effects of psychosocial work characteristics on musculoskeletal disorders, absenteeism, and workplace accidents. Appl Ergon 95:103434, 2021.

12. Rizzo JR, House RJ, Lirtzman SI: Role conflict and ambiguity in complex organizations. Adm Sci Q 15:150-163, 1970.

13. Kahn RL, Wolfe DM, Quinn RP, Snoek JD, Rosenthal RA: Organizational Stress: Studies in Role Conflict and Ambiguity. 2nd ed. New York, John Wiley; 1964

14. Beehr TA, Walsh JT, Taber TD: Relationships of stress to individually and organizationally valued states higher order needs as a moderator. J Appl Psychol 61:41, 1976.

15. Vleeshouwers J, Fløvik L, Christensen JO, et al. The relationship between telework from home and the psychosocial work environment a systematic review. Int Arch Occup Environ Heal 95:2025-2051, 2022.

16. Knardahl S, Christensen JO: Working at home and expectations of being available effects on perceived work environment, turnover intentions, and health. Scand J Work Environ Heal 48:99-108, 2022.

17. Zapf D, Vogt C, Seifert C, Mertini H, Isic A: Emotion work as a source of stress: The concept and development of an instrument. Eur J Work Organ Psychol 8:371-400, 1999.

18. Dormann C, Zapf D: Customer-related social stressors and burnout. J Occup Heal Psychol 9:61, 2004.

19. Zapf D, Holz M: On the positive and negative effects of emotion work in organizations. Eur J Work Organ Psychol 15:1-28, 2006.

20. Abraham R: Emotional dissonance in organizations antecedents, consequences, and moderators. Genet Social Gen Psychol Monogr 124:229, 1998.

21. Zapf D: Emotion work and psychological well-being: A review of the literature and some conceptual considerations. Hum Resour Manag Rev 12:237-268, 2002.

22. Finne LB, Christensen JO, Knardahl S: Psychological and social work factors as predictors of mental distress and positive affect a prospective, multilevel study. PloS One 11:e0152220, 2016.

23. Johannessen HA, Tynes T, Sterud T: Effects of occupational role conflict and emotional demands on subsequent psychological distress. J Occup Environ Med 55:605-613, 2013.

24. Schmidt S, Roesler U, Kusserow T, Rau R: Uncertainty in the workplace examining role ambiguity and role conflict, and their link to depression—a meta-analysis. Eur J Work Organ Psychol 23:91-106, 2014.

25. Vargas-Prada S, Serra C, Martínez JM, et al. Psychological and culturally-influenced risk factors for the incidence and persistence of low back pain and associated disability in Spanish workers findings from the CUPID study. Occup Environ Med 70:57-62, 2013.

26. Carlino E, Benedetti F: Different contexts, different pains, different experiences. Neuroscience 338:19-26, 2016.

27. Nielsen MB, Christiansen S, Indregard AMR, Emberland JS, Elka S, Knardahl S: The new workplace II protocol for a prospective full-panel registry study of work factors, sickness absence, and exit from working life among Norwegian employees. Springerplus 5:1-10, 2016.

28. World Organization of National Colleges Academies and Academic Associations of General Practitioners Family Physicians: ICPC-2 : International Classification of Primary Care. 2nd ed. Oxford, Oxford University Press; 1999

29. Berg R, Jardim PSJ, Holte HH: Forskning om Tiltak for Aredusere Langvarige og Hyppige Sykefravær i Arbeidslivet. Oslo, Folkehelseinstituttet (FHI); 2021

30. Christensen JO, Knardahl S: Work and headache a prospective study of psychological, social, and mechanical predictors of headache severity. Pain 153:2119-2132, 2012.

31. Steingrímsdóttir OA, Vøllestad NK, Røe C, Knardahl S: Variation in reporting of pain and other subjective health complaints in a working population and limitations of single sample measurements. Pain 110:130-139, 2004.

32. Dallner M, Elo AL, Gamberale F, *et al.* Validation of the General Nordic Questionnaire ((QPSNordic)) for Psychological and Social Factors at Work. 1st ed. Copenhagen, Nordic Council of Ministers; 2000

33. Wännström I, Peterson U, Åsberg M, Nygren Å, Gustavsson JP: Psychometric properties of scales in the General Nordic Questionnaire for Psychological and Social Factors At Work (QPSNordic) confirmatory factor analysis and prediction of certified long-term sickness absence. Scand J Psychol 50:231-244, 2009. https://doi.org/10.1111/j.1467-9450.2008.00697.x

34. R Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing, 2022. https://www.R-project.org/.

35. Muthén LK, Muthen B: Mplus User's Guide Statistical Analysis With Latent Variables, User's Guide. Los Angeles, CA, Muthén & Muthén; 2017

36. Spurk D, Hirschi A, Wang M, Valero D, Kauffeld S: Latent profile analysis: A review and "how to" guide of its application within vocational behavior research. J Vocat Behav 120:103445, 2020.

37. von Eye A, Bogat GA: Person-oriented and variable-oriented research: Concepts, results, and development. Merrill-Palmer Q 53:390-420, 2006.

38. Masyn KE: Latent class analysis and finite mixture modeling. In: Little TD, editor. The Oxford Handbook of Quantitative Methods. New York, Oxford University Press; 2013. pp 551-611 .

39. Nylund KL, Asparouhov T, Muthén BO: Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. Struct Equ Model A Multidiscip J 14:535-569, 2007.

40. Asparouhov T, Muthen B: Auxiliary variables in mixture modeling: 3-step approaches using Mplus. Mplus Web Notes 15:1-51, 2013.

41. Asparouhov T, Muthén B: Auxiliary variables in mixture modeling: Three-step approaches using Mplus. Struct Equ Model A Multidiscip J 21:329-341, 2014.

42. Muthen BO, Satorra A: Complex sample data in structural equation modeling. Sociol Methods 25:267-316, 1995.

43. Rugulies R, Christensen KB, Borritz M, Villadsen E, Bültmann U, Kristensen TS: The contribution of the psychosocial work environment to sickness absence in human service workers: Results of a 3-year follow-up study. Work Stress 21:293-311, 2007.

44. Senn S: Baseline adjustment in longitudinal studies. Wiley StatsRef: Stat Ref Online, Published 2014. https://onlinelibrary.wiley.com/doi/10.1002/9781118445112.stat05491. Accessed August 23, 2023.

45. Fisher CD, Gitelson R: A meta-analysis of the correlates of role conflict and ambiguity. J Appl Psychol 68:320, 1983.

46. Örtqvist D, Wincent J: Prominent consequences of role stress a meta-analytic review. Int J Stress Manag 13:399, 2006.

47. Aagestad C, Johannessen HA, Tynes T, Gravseth HM, Sterud T: Work-related psychosocial risk factors for long-term sick leave. J Occup Environ Med 56:787-793, 2014.

48. Jansen NW, Kant I, Amelsvoort LG, van Kristensen TS, Swaen GM, Nijhuis FJ: Work–family conflict as a risk factor for sickness absence. Occup Environ Med 63:488-494, 2006.

49. Hagqvist E, Lidwall U, Leineweber C: Is work–life interference a risk factor for sickness absence? A longitudinal study of the Swedish working population. Eur J Public Heal 32:398-401, 2022.

50. Lidwall U, Marklund S, Voss M: Work–family interference and long-term sickness absence a longitudinal cohort study. Eur J Public Heal 20:676-681, 2010.

51. Aronsson G, Hagberg J, Björklund C, *et al.* Health and motivation as mediators of the effects of job demands, job control, job support, and role conflicts at work and home on sickness presenteeism and absenteeism. Int Arch Occup Environ Heal 94:409-418, 2021.

52. Lee Y: Identifying latent profiles in work-to-family conflict and family-to-work conflict. Hum Resour Dev Q 29:203-217, 2018.

53. Zhang C, Dik BJ, Dong Z: Living a calling and work–Family interface a latent profile analysis. J Career Assess 30:23-40, 2022.

54. Goode WJ: A theory of role strain. Am Sociol Rev 25:483-496, 1960.

55. Lazarus RS, Folkman S: Stress, Appraisal, and Coping. New York, Springer Publishing Company; 1984

56. Bakker AB, Demerouti E: The job demands-resources model state of the art. J Manag Psychol 22:309-328, 2007.

57. Hobfoll SE, Shirom A: Conservation of resources theory: Applications to stress and management in the workplace. Handbook of Organization Behavior. New York, Routledge; 2000. pp 57-80 .

58. Mcewen B, Stellar E: Stress and the individual - Mechanisms leading to disease. Arch Intern Med 153:2093-2101, 1993.

59. McEwen BS: Stress, adaptation, and disease allostasis and allostatic load. Ann N Y Acad Sci 840:33-44, 1998.

60. Mcewen B: Allostasis and allostatic load implications for neuropsychopharmacology. Neuropsychopharmacology 22:108-124, 2000.

61. Pensola T, Haukka E, Kaila-Kangas L, Neupane S, Leino-Arjas P: Good work ability despite multisite musculoskeletal pain? A study among occupationally active Finns. Scand J Public Heal 44:300-310, 2016.

62. Eisenberger N: Social pain and the brain controversies, questions, and where to go from here. Annu Rev Psychol 66:601-629, 2015.

63. Cohen S, Janicki-Deverts D, Doyle W, Miller G, Frank E, Rabin B: Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. Proc Natl Acad Sci 109:5995-5999, 2012.

64. Hernán MA, Hernández-Díaz S, Robins JM: A structural approach to selection bias. Epidemiology 15:615-625, 2004.

65. Schalm RL, Kelloway EK: The relationship between response rate and effect size in occupational health psychology research. J Occup Heal Psychol 6:160, 2001.