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Work stress and quality of life in persons with disabilities from four European countries: the case of spinal cord injury

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Abstract
Background Evidence on the adverse effects of work stress on quality of life (QoL) is largely derived from general populations, while respective information is lacking for people with disabilities. We investigated associations between work stress and QoL and the potentially moderating role of socioeconomic circumstances in employed persons with spinal cord injury (SCI).
Methods Cross-sectional data from 386 employed men and women with SCI (≥18 work h/week) from the Netherlands, Switzerland, Denmark, and Norway were analyzed. Work stress was assessed with the 'effort–reward imbalance' (ERI) model and the control component of the 'demand/control' model. QoL was operationalized with five WHOQoL BREF items. Socioeconomic circumstances were measured by years of formal education and perception of financial hardship. We applied ordinal and linear regressions to predict QoL and introduced interaction terms to assess a potential moderation of socioeconomic circumstances.
Results Multivariate analyses showed consistent associations between increased ERI and decreased overall QoL (coefficient -1.55, $p < 0.001$), domain-specific life satisfaction (health -1.32, $p < 0.001$; activities of daily living -1.28, $p < 0.001$; relationships -0.84, $p = 0.004$; living conditions -1.05, $p < 0.001$), and the QoL sum score (-2.40, $p < 0.001$). Low job control was linked to decreased general QoL (0.13, $p = 0.015$), satisfaction with relationships (0.15, $p = 0.004$), and QoL sum score (0.15, $p = 0.029$). None of the tested interaction terms were significant.
Conclusion ERI was consistently related to all indicators of QoL, while associations with job control were less consistent. Our results do not support the notion that unfavorable socioeconomic circumstances moderate the association between work stress and QoL among persons with SCI.

Keywords Effort–reward imbalance · Job control · Spinal cord injury · Socioeconomic position

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Introduction

Quality of life (QoL) of people with disabilities varies according to type and severity of the health condition [1], dispositional traits and coping characteristics [2] as well as

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circumstances of their social environment such as social network and support [3], socioeconomic circumstances [4, 5], or participation in productive activities [6]. Paid work is a core productive activity with a strong impact on QoL [7–10]. Yet, relatively few studies addressed this topic in people with disabilities, especially so with regard to stressful psychosocial work environments [11–14], which are highly prevalent in modern economies [15].

Exposures to stressful psychosocial work environments have been described by two internationally established models, the 'demand/control' model [16] and the 'effort–reward imbalance' (ERI) model [17]. The demand/control model defines work stress in terms of a distinct job task profile where jobs defined by high quantitative demands in combination with low job control (low decision latitude, little possibility to influence organization or pace of work) are stressful [18]. The ERI model assumes that work implies a psychological contract, which is based on the norm of social reciprocity. Efforts should be balanced by rewards provided in terms of money, esteem, and career opportunities (promotion prospects, job security) [19]. The model assumes that a lack of reciprocity (high effort in combination with low reward) generates strong negative emotions with adverse long-term effects on QoL, mental and physical health [20–22]. Available evidence further suggests that the impact of stressful work environments is moderated by socioeconomic circumstances such as education or income. It is further assumed that persons in low socioeconomic positions have restricted access to protective resources for coping with adversity [23]. Previous research in general populations demonstrated that persons in unfavorable socioeconomic conditions suffering from work stress had an increased risk of depression [24, 25], stroke [26], and low self-rated health [25] as compared to persons with the same work stress level but more favorable socioeconomic conditions. However, to our knowledge, no study has tested this hypothesis in employed men and women with disabilities so far. Considering socioeconomic circumstances might be important to identify particularly vulnerable groups of employees with disabilities when designing interventions to reduce work stress.

In this study, we aim to first test the hypothesis that stressful work environments lead to decreased QoL in employees with disabilities, namely in persons with spinal cord injury (SCI). SCI is a condition characterized by severe functional limitations [27] that may cause a substantial need for vocational rehabilitation [28, 29]. Previous research demonstrated a generally decreased level of QoL in persons with SCI as compared to the general population [1, 30, 31]. It is conceivable that stressful working conditions lead to an additional decrease in QoL. Second, we test the moderation hypothesis stating that the effect of stressful work on QoL is amplified in persons with lower education and financial difficulties as compared to those with higher education and less financial difficulties.

Methods

Design and sample

We used observational cross-sectional data from the International Labor Market Integration Assessment (ILIAS; www.ilias-survey.eu) and the community survey of the Swiss Spinal Cord Injury (SwiSCI) Study [32]. Both surveys were conducted between mid-2012 and early 2013 and included persons with traumatic or non-traumatic SCI aged over 16 years, living in one of the four participating countries, i.e., Denmark, the Netherlands, Norway, and Switzerland. The SwiSCI population study was recruited through the National Association of Persons with SCI, three specialized SCI rehabilitation centers, and an institution providing home care for people with SCI [32]. The ILIAS participants were recruited through National Associations of Persons with SCI only. Among others, the SwiSCI survey incorporated the ILIAS items. Data were collected by written or online questionnaires (in special cases by telephone interviews). This study has been approved by the Medical Ethical Committee of the Canton Lucerne, Switzerland.

The following analyses were restricted to employed males and females who worked at least 18 h per week at the time of the study. Additionally, 12 cases with missing data on employment status in combination with missing in all work-stress-related variables were excluded. These restrictions led to a total sample of 386 persons. The eligibility criterion of working at least 18 h was based on the assumption that the amount of time of exposure to adverse working conditions had to be considerable in order to potentially impact employees' QoL.

Measures

Work stress

The psychosocial work environment was measured with the ERI short form [33] addressing 'effort' (3 items) and 'reward' (7 items), and by a short scale 'control' (3 items), based on the Job Content Questionnaire [16]. The ERI short form showed satisfying reliability (Cronbach's alpha effort scale: 0.80, reward scale: 0.84) and good discriminant validity as a series of analyses of variances with predefined subgroups (e.g., gender, age, socioeconomic circumstances, occupational grade) revealed significant differences in scales between groups [34]. Furthermore, the

criterion validity of ERI short form was confirmed in two studies [33, 34]. For the Job Content Questionnaire, satisfying reliability (Cronbach's alpha for subscale 'decision latitude': 0.78 [18]), predictive validity [16], and content and discriminant validity have been reported [18]. The ERI items were answered on a four-point Likert scale. In accordance with the theoretical assumption of the ERI model, a ratio of the two scales was constructed, defined as the sum scores of the 'effort' items (nominator) and the 'reward' items (denominator, adjusted for number of items). The reward subscale was calculated if at least five of the seven items were completed, and the effort subscale was computed if at least two of the three items were completed. Thus, a quantitative estimate of the mismatch between 'cost' and 'gain' at individual level was available, with values exceeding 1.0 indicating stressful experiences at work [17]. In the case of the demand/control model, we restricted our analysis to 'job control,' given its power in explaining health- and QOL-related outcomes [35–37]. To assess 'job control,' participants were asked to rate their ability to influence work organization, work pace, and policy decisions in the organization on a scale from 1 (no influence) to 10 (complete control). A mean score for job control was calculated if at least two of the three items were completed.

Quality of life was assessed with five selected 5-point Likert scale items from the WHOQoL BREF [38]. These items cover people's perception of overall QoL and domain-specific life satisfaction, i.e. satisfaction with health, social relationships, activities of daily living (ADL), and living conditions. Satisfactory psychometric properties (Rasch-based counterpart of Cronbach's alpha, person reliability index: 0.78), unidimensionality ($\chi^2 = 16.43$, $df = 10$, $p = 0.088$), and cross-cultural validity of this item selection have been demonstrated for the SCI population [10, 39]. The psychometric validation of WHOQol BREF (26-item version) showed satisfactory reliability (Cronbach's alpha: 0.68–0.82) and well performance in preliminary tests of validity (t tests of domain scores for unhealthy vs. healthy samples: $p < 0.01$ for all domains) [40]. We analyzed single items as well as the sum score of the 5-item selection of WHOQoL BREF [38]. We assumed that stressful working conditions were associated with decreased QoL in terms of the above-mentioned single items and their sum score. For all single items, answer categories with prevalence below 5 % were matched with their proximal category. For statistical analyses, 3-level (overall QoL, satisfaction with living conditions) and 4-level (satisfaction with health, ADL, social relationships) categorical variables were used in case of single items, and a continuous variable ranging from 0 to 20 in case of the QoL sum score, with higher scores indicating higher QoL.

Additional variables

Level of education and perceived financial hardship were defined as indicators of individual-level socioeconomic circumstances. Education was classified according to the International Standard Classification of Education as total years of formal education, combining school and vocational training [41]. For bivariate analysis and for interaction terms, years of education were reclassified into distribution-based tertiles (not country specific). In regression analyses, we introduced education in years as ordinal variable. Perceived financial hardship was assessed by the single question 'how do you get along with your current household income?' Answer categories were 'very good,' 'rather good,' 'rather bad,' and 'very bad.' Due to a low prevalence of participants reporting a 'very bad' financial situation, we used three categories for analyses, combining the categories 'rather bad' and 'very bad' into 'less than good.' As financial hardship was a subjective evaluation of the financial situation, we used the term 'socioeconomic circumstances' rather than socioeconomic position, which points at a more objective assessment, e.g., through disposable income or occupational position. Control variables included gender, age, lesion characteristics (para-/tetraplegia, complete/incomplete lesion years since injury), current working hours, and country of residence. For regression analyses, age, years since injury, and current working hours were introduced continuously, and gender, lesion level (para- vs. tetraplegia), completeness of lesion (complete vs. incomplete), and country were introduced categorically.

Statistical analyses

Analyses were conducted using STATA version 12.0 for Windows (College Station, TX, USA).

Following descriptive analysis of the study population, we first explored bivariate associations of work stress, socioeconomic circumstances, and QoL. Due to a rather low sample size in some countries, data were analyzed jointly for all countries.

Second, we applied ordinal logistic regressions using the single indicators of QoL as ordinal outcomes, and linear regression for the continuous QoL sum score. As a prerequisite to apply ordinal regressions, the parallel lines assumption indicating that betas are the same for each transition from an ordinal scale point must be tested and, if necessary, relaxed for particular predictors [42]. Here, the parallel lines assumption was confirmed for all predictors and models (tested with the autofit option of Stata's gologit2 command [42]). Two sets of ordinal regression models were subsequently calculated. In a first step, we regressed QoL on ERI as well as QoL on work control separately. In

a second step, the ER ratio and job control were entered simultaneously. All models were adjusted for age, gender, lesion characteristics (para-/tetraplegia, completeness of lesion, years since injury), work hours, years of formal education, perceived financial hardship, and country of residence. We report regression coefficients, McFadden's pseudo R^2, and p values from likelihood ratio tests. It is important to mention that Pseudo R^2 cannot be interpreted in terms of the R^2 from ordinary least squares regressions, i.e., proportion of explained variance, as it seems to have a serious downward bias in ordinal outcomes [43].

Third, to test the moderation hypothesis (Table 4), we introduced interaction terms between work stress and socioeconomic circumstances in addition to the main effects for ERI and job control as well as financial hardship and years of formal education while adjusting for age, gender, lesion characteristics (para-/tetraplegia, completeness of lesion, years since injury), work hours, and country of residence. For the construction of interaction terms, education was grouped into tertiles for reasons of interpretability. p values of these analyses were Bonferroni-corrected to account for multiple testing.

Missing data

Albeit the number of missing values was low (less than 5 % in all cases), we carried out multiple imputations to address a potential bias due to missing data. More specifically, we used multiple imputation by chained equations (MICE) [44] enabling us to impute different types of variables, including categorical, ordinal, and linear variables. To specify our imputation model, we incorporated all covariates, including the outcome variables of interest [45]. For each model, 10 imputations were carried out. The results from imputed data are not presented in detail, since results remained basically unchanged and confirmed the complete case analyses.

Results

Table 1 provides information on basic characteristics of the study population. With the exception of completeness of lesions, sociodemographic and lesion characteristics did not differ between countries. Mean years of education were somewhat higher in the Netherlands (potentially due to early start of pre-school at age 4), and the perceived financial situation of persons from Denmark and the Netherlands was better than in Norway and Switzerland. On average, QoL was rather high in all countries as we observed low prevalence (<5 %) of the two categories indicating very low and low QoL. The mean ER ratio for all countries was below 1.0, indicating that effort spent and reward received at work were not imbalanced on average. However, ERI in the Netherlands and Switzerland was significantly higher than in the other countries. Mean job control was rather high in all countries.

ERI was related to all indicators of QoL, while associations with job control were less consistent (Table 2). People who indicated higher imbalance between effort and reward at work consistently reported lower general QoL, lower satisfaction with health, ADL, relationships, and living conditions, and scored lower on the QoL sum score. Results showed a consistent gradient in ERI between all levels of QoL, indicating a stepwise increase in QoL with decreasing work stress. We observed trends toward reporting lower QoL in groups with lower job control; differences were significant in general QoL, satisfaction with relationships, satisfaction with living conditions, and the QoL sum score, but non-significant in case of satisfaction with health and ADL. While we found no association between education and work stress, participants' financial situation was linked to both work stress indicators: Persons perceiving financial hardship reported the highest work stress exposure, and even those who reported a rather good financial situation indicated higher work stress than those in a very good financial situation ($p < 0.05$ for work stress differences between 'rather good' and 'very good' financial situation).

Education was only weakly and inconsistently associated with all indicators of QoL (results not shown). We observed marked differences in general QoL and satisfaction with living conditions according to a person's perceived financial situation. In total, 33.3 % of persons perceiving financial difficulties rated their general QoL as less than good, while 23.5 % of persons in a rather good financial situation and only 14.7 % of persons in a very good financial situation reported less than good QoL (p from χ^2 test $= 0.003$). In total, 13.3 % of persons in rather bad financial situation and only 8.8 % of those in very good financial situation were not satisfied with their living conditions ($p = 0.039$). However, associations between financial situation and satisfaction with health, ADL, and relations as well as with the QoL sum score were insignificant (results not shown).

In line with results from bivariate analyses, multivariate analyses confirmed significant associations between ERI and all QoL indicators (Table 3). General QoL, satisfaction with health, ADL, relationships, living conditions, and the QoL sum score increased with a decreasing imbalance between effort and reward. Job control was linked to general QoL, satisfaction with relationships, and the QoL sum score, while associations with satisfaction with health, ADL, and living conditions were non-significant. All effects remained stable after controlling for potential confounders, even if the work stress indicators were controlled

Table 1 Basic characteristics of the study population

Variable [missing values]	Total all countries ($n = 386$)	The Netherlands ($n = 130$)	Switzerland ($n = 109$)	Denmark ($n = 42$)	Norway ($n = 105$)	p for country differences[a]
Sociodemographic characteristics						
Age, Mean (SD)	47.8 (9.4)	47.6 (8.9)	46.9 (10.2)	50.0 (8.7)	48.0 (9.3)	0.574
Male, [1] *n* (%)	287 (74.6)	100 (76.9)	89 (81.7)	27 (65.9)	71 (67.6)	0.056
Working hours/week, mean (SD)	29.5 (9.1)	29.9 (9.1)	29.4 (9.4)	30.4 (8.5)	28.9 (9.1)	0.771
Lesion characteristics						
Paraplegia, [2] *n* (%)	284 (74.0)	92 (71.3)	85 (78.7)	30 (71.4)	77 (73.3)	0.595
Complete lesion, [3] *n* (%)	204 (53.3)	81 (63.3)	51 (46.8)	14 (33.3)	58 (55.8)	0.003
Years since injury, [3] mean (SD)	19.9 (11.7)	19.8 (10.7)	18.1 (11.9)	19.6 (13.6)	22.0 (11.8)	0.126
Socioeconomic circumstances						
Education in years, [4] mean (SD)	15.2 (4.1)	16.8 (3.8)	14.8 (3.3)	14.0 (5.4)	14.1 (4.1)	0.722
Financial situation, [4] *n* (%)						0.010
Very bad[b]	5 (1.3)	0 (0.0)	2 (1.9)	1 (2.4)	2 (1.9)	
Bad[b]	25 (6.5)	5 (3.9)	16 (14.8)	0 (0.0)	4 (3.9)	
Rather good	202 (52.9)	68 (52.7)	54 (50.0)	22 (52.4)	58 (56.3)	
Very good	150 (39.3)	56 (43.4)	36 (33.3)	19 (45.2)	39 (37.9)	
General quality of life, [4] n (%)						0.511
Very poor[b]	1 (0.3)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	
Poor[b]	10 (2.6)	2 (1.6)	3 (2.8)	1 (2.4)	4 (3.9)	
Fair[b]	70 (18.3)	25 (19.4)	20 (18.4)	10 (23.8)	15 (14.7)	
Good	211 (55.2)	72 (55.8)	67 (61.5)	19 (45.2)	53 (52.0)	
Very good	90 (23.6)	30 (23.4)	18 (16.5)	12 (28.6)	30 (29.4)	
Satisfaction with health, [5] n (%)						0.202
Very dissatisfied[b]	17 (4.5)	7 (5.4)	2 (1.9)	2 (4.8)	6 (5.9)	
Dissatisfied[b]	61 (16.0)	14 (10.9)	14 (13.0)	10 (23.8)	23 (22.6)	
Neither nor	88 (23.1)	30 (23.4)	21 (19.4)	10 (23.8)	27 (26.5)	
Satisfied	190 (49.9)	69 (53.5)	63 (58.3)	17 (40.5)	41 (40.2)	
Very satisfied	25 (6.6)	9 (7.0)	8 (7.4)	3 (7.1)	5 (4.9)	
Satisfaction with activities of daily living, [7] n (%)						0.106
Very dissatisfied[b]	8 (2.1)	2 (1.6)	2 (1.9)	3 (7.1)	1 (1.0)	
Dissatisfied[b]	47 (12.4)	19 (14.7)	8 (7.4)	5 (11.9)	15 (15.0)	
Neither nor	60 (15.8)	21 (16.3)	16 (14.8)	4 (9.5)	19 (19.0)	
Satisfied	205 (54.1)	71 (55.0)	56 (51.9)	24 (57.1)	54 (52.0)	
Very satisfied	59 (15.6)	16 (12.4)	26 (24.1)	6 (14.3)	11 (11.0)	
Satisfaction with relationships, [6] n (%)						0.566
Very dissatisfied[b]	4 (1.1)	1 (0.8)	2 (1.8)	1 (2.4)	0 (0.0)	
Dissatisfied[b]	21 (5.5)	6 (4.7)	8 (7.3)	3 (7.1)	4 (4.0)	
Neither nor	46 (12.1)	13 (10.1)	11 (10.1)	3 (7.1)	19 (19.0)	
Satisfied	202 (53.2)	69 (53.5)	60 (55.1)	22 (52.4)	51 (51.0)	
Very satisfied	107 (28.2)	40 (31.0)	28 (25.7)	13 (31.0)	26 (26.0)	
Satisfaction with living conditions, [5] n (%)						0.001
Very dissatisfied[b]	5 (1.3)	0 (0.0)	1 (0.9)	1 (2.4)	3 (2.9)	
Dissatisfied[b]	11 (2.9)	4 (3.1)	4 (3.7)	1 (2.4)	2 (2.0)	
Neither nor[b]	31 (8.1)	13 (10.1)	6 (5.6)	1 (2.4)	11 (10.8)	
Satisfied	154 (40.4)	73 (56.6)	36 (5.6)	16 (38.1)	29 (28.4)	
Very satisfied	180 (47.2)	39 (30.2)	61 (56.5)	23 (54.8)	57 (55.9)	

Table 1 continued

Variable [missing values]	Total all countries ($n = 386$)	The Netherlands ($n = 130$)	Switzerland ($n = 109$)	Denmark ($n = 42$)	Norway ($n = 105$)	p for country differences[a]
Quality of life sum score, [8] mean (SD)	19.4 (3.1)	19.3 (3.1)	19.7 (2.9)	19.2 (3.4)	19.1 (3.2)	0.534
Lowest tertile (0–9), *n* (%)	118 (31.2)	39 (30.2)	30 (27.8)	12 (28.6)	37 (37.4)	0.726
Middle tertile (10–11), *n* (%)	109 (28.8)	40 (31.0)	32 (29.6)	14 (33.3)	23 (23.2)	
Highest tertile (12–16), *n* (%)	151 (40.0)	50 (38.8)	46 (42.6)	16 (38.1)	39 (39.4)	
Work stress, mean (SD)						
Reward [10]	20.6 (3.7)	19.8 (3.2)	20.8 (3.5)	20.8 (3.9)	21.5 (4.1)	0.005
Subscale esteem	6.3 (1.3)	5.9 (1.1)	6.3 (1.3)	6.8 (1.5)	6.5 (1.5)	<0.001
Subscale promotion	8.2 (1.2)	8.0 (1.0)	8.2 (1.2)	8.1 (1.4)	8.4 (1.4)	0.104
Subscale security	3.8 (1.4)	4.2 (1.3)	3.6 (1.4)	3.7 (1.3)	3.4 (1.4)	<0.001
Effort [4]	7.8 (2.0)	8.2 (1.7)	8.4 (1.9)	6.6 (2.3)	7.1 (2.0)	<0.001
Effort-reward ratio [10]	0.9 (0.4)	1.0 (0.4)	1.0 (0.4)	0.8 (0.3)	0.8 (0.5)	0.005
Mean job control [9]	7.1 (2.1)	7.2 (2.0)	6.9 (2.4)	7.1 (1.6)	7.1 (2.2)	0.674

[a] p values from ANOVA for continuous variables, p values from χ^2 for categorical variables

[b] Due to prevalence below 5 %, categories are combined for analyses

for each other (Model 2). Although the same direction of associations between work stress and QoL has been observed in both genders, associations were slightly stronger in males than in females (non-significant in females, results not shown).

The correlation coefficient between ERI and job control was -0.179 ($p = 0.0005$), indicating that the two work stress indicators potentially reflect different aspects of perceived psychosocial adversity at work. Model fit statistics indicated that the introduction of control variables increased the explanatory power of the models. Also, the explanatory power of ERI is somewhat higher compared with job control. Notably, in model 1, fits are higher for ERI compared with job control, which is true for all outcomes under study.

Interactions between work stress measures and socioeconomic circumstances were tested together with the main effects (Table 4). In both genders, we found no support of the moderating hypothesis stating that the negative effects of stressful work on QoL were amplified in persons with lower education or those perceiving financial hardship. Testing these interactions in a model including all variables simultaneously did also not result in significant interaction terms (results not shown).

Discussion

In this study, we analyzed associations between work stress and QoL among employed men and women with SCI. We found consistent associations of stressful work in terms of ERI with all indicators of QoL, while job control was related to three out of six indicators. Thus, in the majority of cases, results provide support for our main hypothesis that QoL of employees with SCI varies according to exposure to a stressful psychosocial work environment (with slightly stronger associations for men as compared to women). In contrast, we did not find support in favor of the moderation hypothesis postulating that the effect of stressful work on QoL is amplified in persons with low education or those perceiving financial hardship. Therefore, it is unlikely that employees with disabilities in unfavorable socioeconomic circumstances suffer more from work-related reductions in QoL as compared to those who are better off. To summarize, this is one of the first studies demonstrating associations of stressful work, based on two established theoretical models, with reduced QoL in a large sample of employed men and women with disabilities.

The consistent findings concerning the ERI model are in line with those reported from studies on general working populations. For instance, previous studies demonstrated that a mismatch between effort and reward at work is associated with reduced QoL among general working populations [46] and in different occupational groups such as nurses [47], health care workers [48, 49], or employees from a manufacturing plant [50]. Our findings provide partial support for the hypothesis that low job control is associated with reduced QoL. Similar to our results, the ERI components were stronger predictors of poor well-being than low job control after simultaneous adjustments in a sample of 11,636 Dutch employees [46]. This may be due to the fact that the ERI model assesses dimensions of the work situation that are more closely linked to the

Table 2 Differences in work stress between groups of quality of life and socioeconomic circumstances, mean (standard deviation)

Range	Effort-reward ratio 0.25–4.00	Job control 1–10
Quality of life		
General quality of life		
Less than good	1.11 (0.61)	6.50 (2.15)
Good	0.94 (0.31)	6.99 (2.06)
very good	0.77 (0.26)	7.64 (2.15)
p^a	<0.001	<0.001
p^b	<0.000	<0.001
Satisfaction with health		
(Very) dissatisfied	1.11 (0.59)	6.72 (2.01)
Neither dissatisfied nor satisfied	0.91 (0.36)	7.05 (2.01)
Satisfied	0.90 (0.30)	7.20 (2.16)
Very satisfied	0.78 (0.33)	6.92 (2.54)
p^a	<0.001	0.281
p^b	0.002	0.077
Satisfaction with activities of daily living		
(Very) dissatisfied	1.10 (0.63)	6.85 (2.06)
Neither dissatisfied nor satisfied	0.98 (0.41)	6.97 (1.85)
Satisfied	0.90 (0.33)	7.11 (2.16)
Very satisfied	0.87 (0.31)	7.18 (2.35)
p^a	0.034	0.465
p^b	0.005	0.122
Satisfaction with relationships		
(Very) dissatisfied	1.16 (0.58)	6.49 (2.04)
Neither dissatisfied nor satisfied	0.98 (0.38)	6.32 (2.29)
Satisfied	0.95 (0.42)	7.03 (2.05)
Very satisfied	0.84 (0.27)	7.53 (2.14)
p^a	0.028	0.001
p^b	0.004	<0.001
Satisfaction with living conditions		
Less than satisfied	1.16 (0.62)	6.25 (2.26)
Satisfied	0.96 (0.41)	7.10 (1.90)
Very satisfied	0.86 (0.29)	7.21 (2.25)
p^a	<0.001	0.012
p^b	<0.001	0.005
Quality of life sum score		
Lowest tertile	1.06 (0.54)	6.80 (2.05)
Middle tertile	0.95 (0.32)	6.71 (2.12)
Highest tertile	0.84 (0.28)	7.50 (2.14)
p^a	0.001	<0.001
p^b	<0.001	<0.001
Socioeconomic circumstances		
Education in years (tertiles)		
Low	0.94 (0.45)	6.90 (2.18)
Middle	0.94 (0.41)	7.08 (2.22)
High	0.93 (0.31)	7.27 (1.95)
p^a	0.771	0.524
p^b	0.485	0.264
Financial situation		
Less than good	1.19 (0.56)	5.98 (2.45)
Rather good	0.93 (0.34)	6.95 (2.12)
Very good	0.87 (0.38)	7.45 (1.95)
p^a	<0.001	0.002
p^b	<0.001	<0.001

[a] p values from Kruskal–Wallis tests (adjusted for ties) for the comparison of groups with different QoL levels or in different socioeconomic circumstances (education or financial situation)

[b] p values from Cuzick test for trend across ordered groups

Table 3 Coefficients of ordinal and linear regressions of quality of life on work stress indicators, adjusted for confounders

	Effort–reward ratio		Job control	
	β	Pseudo R^2	β	Pseudo R^2
General quality of life (n = 357)				
Model 1	−1.67***	0.1038	0.16**	0.0774
Model 2	−1.55***	0.1120	0.13*	0.1120
Satisfaction with health (n = 356)				
Model 1	−1.34***	0.0600	0.05	0.0372
Model 2	−1.32***	0.0602	0.02	0.0602
Satisfaction with activities of daily living (n = 355)				
Model 1	−1.31***	0.0654	0.06	0.0445
Model 2	−1.28***	0.0657	0.03	0.0657
Satisfaction with relationships (n = 355)				
Model 1	−0.92**	0.0467	0.16**	0.0464
Model 2	−0.84**	0.0570	0.15**	0.0570
Satisfaction with living conditions (n = 356)				
Model 1	−1.08***	0.0788	0.08	0.0622
Model 2	−1.05***	0.0808	0.06	0.0808
Quality of life sum score (n = 354)				
Model 1	−2.63***	0.1856	0.22**	0.1121
Model 2	−2.52***	0.1966	0.16*	0.1966

Model 1: adjusted for age, gender, lesion characteristics (para-/tetraplegia, completeness of lesion, years since injury), work hours, education, financial situation, and country of residence

Model 2: Model 1 + effort–reward ratio and job control adjusted for each other

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$, p values from likelihood ratio tests

everyday experience of employees (e.g., time pressure, respect, interruptions) as compared to job control. Compared with findings from general working populations [51], our study revealed that the association of work stress and QoL was more pronounced in males than in females. It is assumed that the work role receives more importance in

Table 4 Coefficients of linear regressions testing interactions and main effects of work stress and socioeconomic circumstances on the quality of life sum score

	Quality of life sum score	
	β	Pseudo $R2$
Effort–reward imbalance (ERI)	−2.71*	0.2140
High education	Reference group	
Medium education	0.92	
Low education	−0.39	
ERI × high education	Reference group	
ERI × medium education	−0.42	
ERI × low education	1.17	
p for interaction term	0.151	
Job control	0.37	0.1322
High education	Reference group	
Medium education	1.75	
Low education	2.92	
Job control × high education	Reference group	
Job control × medium education	−0.17	
Job control × low education	−0.30	
p for interaction term	0.312	
Effort–reward imbalance (ERI)	−2.73**	0.2003
Very good financial situation	Reference group	
Good financial situation	−1.09	
Financial hardship	−0.75	
ERI × very good financial situation	Reference group	
ERI × good financial situation	0.49	
ERI × financial difficulties	0.26	
p for interaction term	0.844	
Job control	0.10	0.1232
Very good financial situation	Reference group	
Good financial situation	−1.98	
Financial hardship	−1.42	
Job control × very good financial situation	Reference group	
Job control × good financial situation	0.18	
Job control × financial difficulties	0.06	
p for interaction term	0.523	

All models are adjusted for lesion characteristics (para-/tetraplegia, completeness of lesion, years since injury), work hours, country of residence, and socioeconomic circumstances

* $p < 0.05$; ** $p < 0.01$, p values for coefficients from Wald tests, p values for interaction terms from likelihood ratio tests. All p values were Bonferroni-corrected

males, and therefore, adverse working conditions in terms of work stress may have a stronger impact on QoL in males than in females who may be engaged in a multitude of socially productive activities such as family or household activities [51]. Overall, the work stress level observed in our study is comparable to other populations [17].

Although the moderation hypothesis is theoretically appealing, empirical evidence in favor of this assumption is not consistent. For instance, in a recent systematic review of results testing the moderation hypothesis in epidemiological cohort studies, only four out of nine reports observed an effect in the expected direction [52]. When interpreting the result of our cross-sectional study, one should keep in mind that our sample of persons with SCI was recruited from countries with well-developed national social security policies. These policies might, to some extent, mitigate the negative effects of adverse working and living conditions associated with adverse socioeconomic circumstances on people's QoL. It would therefore be important to further test the moderation hypothesis in countries with poorly developed social policies. In addition, strong social support or social capital, an important protective factor in SCI [3], might, to some extent, buffer adverse effects of stressful conditions on QoL. Despite the lack of evidence for the moderation hypothesis in this population, socioeconomic adversity in terms of financial hardship was significantly associated with psychosocial stress at work as well as poor QoL.

Several limitations have to be considered. First, given the cross-sectional study design, no conclusion concerning the direction of effects in reported associations can be drawn. We cannot rule out that poor QoL affects the reporting of stressful psychosocial work. There is nevertheless some evidence available from prospective investigations supporting the interpretation of an effect of stressful work on QoL [21, 53]. Second, we cannot assume that the results can be generalized to populations with SCI at large as a detailed analysis of potential bias due to unit non-response is not available. Also, generalizability is limited as we excluded persons who work less than 18 h per week. Third, we cannot rule out common method variance due to the fact that main variables are based on self-report data. Yet, studies controlling for reporting bias due to negative affectivity or other dispositional traits show a relatively low risk [54–56]. Fourth, although our measurement of a psychosocial work environment relied on validated scales, we did not include all scales of the two models (excluding 'demand' in the demand/control model and 'overcommitment' in the ERI model), thus precluding a comprehensive test of the full models. Additionally, it might be worthwhile to test the interactions of work stress and socioeconomic circumstances with other—

more objective—indicators of social position as education and perceived financial hardship may not fully reflect socioeconomic disadvantages.

These limitations are balanced by several strengths. First, to our knowledge, this is the first study testing two internationally established work stress models in employed persons with SCI. Second, in view of the fact that SCI is a relatively rare condition, we were able to recruit one of the largest samples of persons with SCI participating in the labor market in Europe. Third, the data used in this study have a very low number of missing values, and a special emphasis was put on controlling for bias due to item nonresponse. Since imputed results confirmed results of the complete case analyses, a bias introduced by item nonresponse is rather unlikely.

Conclusion

In a large sample of employed persons with SCI, work stress in terms of effort–reward imbalance was associated with all QoL indicators, while associations with job control were less consistent. The hypothesis that unfavorable socioeconomic circumstances moderate the association between work stress and QoL was not confirmed in this sample drawn from countries with well-developed social policies. While employment and return to work in persons with SCI have been extensively studied [28], less effort has been made toward creating healthy working conditions for successfully reintegrated persons. Our results underline the importance of health management programs to decrease work-related stressors to ultimately improve QoL of employees with SCI. Long-term studies on the effects of interventions to reduce psychosocial work stress and to enhance mental health have provided promising results that might be applicable to employees with disabilities [57].

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