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EFFORT–REWARD IMBALANCE, OVERCOMMITMENT AND THEIR ASSOCIATIONS WITH ALL-CAUSE AND MENTAL DISORDER LONG-TERM SICK LEAVE – A CASE-CONTROL STUDY OF THE SWEDISH WORKING POPULATION

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Abstract
Objectives: To investigate if effort–reward imbalance (ERI) and overcommitment (OC) are associated with all-cause and mental disorder long-term sick leave (LS), and to identify differences in associations between genders, private versus public sector employees and socioeconomic status groups. **Material and Methods:** The study uses a cross-sectional case-control design with a sample of 3477 persons on long-term sick leave of more than 59 days and a control group of 2078 in employment. Data on sick leave originate from social insurance registers, while data on health, working and living conditions were gathered through a survey. The binary logistic regression was used to test the multivariate associations. **Results:** Effort–reward imbalance was associated with all-cause LS among the women (odds ratio (OR) = 1.58, 95% confidence interval (CI): 1.2–2.08), but not among the men. Associations for mental disorder LS were evident for both ERI and OC among both genders (ERI/OC: women OR = 2.76/2.82; men OR = 2.18/2.92). For the men these associations were driven by high effort, while for the women it was low job esteem in public sector and low job security in private sector. Among the highly educated women, ERI was strongly related to mental disorder LS (OR = 6.94, 95% CI: 3.2–15.04), while the highly educated men seemed to be strongly affected by OC for the same outcome (OR = 5.79, 95% CI: 1.48–22.57). **Conclusions:** The study confirmed the independent roles of ERI and OC for LS, with stronger associations among the women and for mental disorders. The ERI model is a promising tool that can contribute to understanding the prevailing gender gap in sick leave and increasing sick leave due to mental disorders. Int J Occup Med Environ Health 2016;29(6):973–989

Key words:
Mental disorders, Sick leave, Gender, Working population, Case-control study, Effort–reward imbalance

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INTRODUCTION

Considerable research has established the link between psychosocial work environment exposures and various health-related outcomes. The Demand and Control Model (DC model), introduced by Karasek in 1979, has been the most widely used model in the field [1,2]. Its relevance for prediction of sick leave is fairly well documented [3]. The most evident adverse work situation in the DC model is where high psychological demands are accompanied by low control, which is known as a job-strain hypothesis [1,2].

Later, Johannes Siegrist introduced the effort–reward imbalance model (ERI model) with the basic idea that there is a need for equity and reciprocity of exchange in the job situation between efforts (demands) and rewards [4]. The lack of reciprocity is presupposed to lead to a condition of emotional distress with an increased risk of mental and physical illness [5].

In the ERI model, the "rewards" in the shape of formal and informal work contracts comprise money, esteem and status control. Such features can be more fluent in rapidly changing global economies and could possibly override the DC model's concept of "work control" in a modern work life [4,6–8]. However, over time the DC and ERI models have been seen as being complementary rather than competing models [6,8,9]. Another feature associated with the ERI model is the personal trait of "overcommitment" meaning excessive endeavour by an employee. Overcommitment (OC) may, itself, be a risk factor for adverse health outcomes but it could also exacerbate the negative effects of ERI [4,6,9].

ERI and sick leave

The ERI model has been used in a growing number of studies of sick leave and other health related outcomes [8]. An increased risk of all-cause sick leave following exposure to ERI has been reported in prospective studies of British civil servants [10] and among workers in 3 Dutch companies [11]. However, negative findings have also been reported. In a prospective Danish working population study, apart from low reward, ERI was not associated with long-term sick leave (LS) [12]. In general, there is a scarcity of studies on ERI and all-cause sick leave, particularly for general working populations.

In a previous large-scale cross-sectional study of the Swedish working population, active jobs among women were positively associated with LS exceeding 2 months, which contradicted the positive "active learning hypothesis" in the DC model that presupposes a reduced risk of sick leave [13]. Such a result for women has been also reported in a longitudinal Swedish study [14]. These incongruences with the DC model could potentially be due to the negative impact of ERI and OC among Swedish women, which was not assessed in those studies. In the current study, associations between ERI and LS have been analysed, for the first time in a Swedish context, in a large-scale study of the working population. Only one study on ERI and sick leave has been conducted in a Swedish setting. This was a cross-sectional study, restricted to women in a single occupational group, which has reported an association between ERI and sick leave exceeding 3 weeks [15].

Sick leave compensated by sickness insurance in Sweden

Historically, Sweden has had high rates of sick leave but there was a decrease since 2003 partly due to the stricter sickness insurance regulations [16]. An increased exposure to adverse psychosocial working conditions during the 1990's has been proposed as an important factor behind increased LS in Sweden at the turn of the century [16,17]. According to Swedish work environment surveys, exposure to psychosocial work hazards, which rose during the 1990's, seems to persist at a high level with an increased number of exposed in recent years [18]. Recently, sick leave has risen again, particularly among women and because of mental disorders [19]. The reduced ability

to perform productive work due to mental disorders in the working age population is a growing concern both in Sweden and abroad [20,21].

The Swedish sickness insurance scheme requires a doctor's certificate from the 8th day of a sick leave period [19]. Compared with short-term sick leave, LS could be considered to be less voluntary and more closely related to an illness and a disease [22–24]. Lengthy sick leave also increases the risk of exclusion of an individual from the labour market, by disability pension for example, and therefore, compared to the short-term sick leave, it has a more profound impact on the well-being of an individual and economic costs for the society [25]. In the current study, the definition of LS is a medically certified absence exceeding 2 months. This substantially reduces the number of absences due to less severe ailments such as upper respiratory diseases and other physical diseases more closely associated with other factors that are not work-related [25,26].

The choice of a duration cut-off point in the definition of medically certified LS is rather arbitrary in the literature, and also depends on the sickness absence insurance scheme in a particular setting under investigation as well as on availability of data [27]. The divergent definitions that have been applied could pose a problem when trying to compare the results of different studies [28]. However, despite the use of disparate measures of LS in different settings, many of the findings indicate similar mechanisms behind LS [27].

ERI and mental disorders

The link between adverse psychosocial work environments and mental disorders is well established in the literature, and the evidence regarding specific negative impact of ERI on mental health is also growing [29–31]. Support is also growing for the negative effects of ERI on work ability and extensive sick leave due to mental disorders [32–35]. A German cohort study of mainly white-collar workers aged 30–59 years has reported substantial effects of ERI on work ability and, especially, on mental health [32]. In a Belgian cohort study of middle-aged workers, higher rewards reduced the risk of long-term mental disorder sick leave [33]. In a Canadian cohort study of office workers, low rewards among men and ERI among women were associated with medically certified sick leave for mental disorders exceeding 4 days [34]. A Finnish cohort study of public sector employees has reported an increased risk for disability pension due to depression for subjects with high levels of ERI at both individual and workplace levels [35].

ERI in different strata of the working population

Effort–reward imbalance and overcommitment may also be more prominent in the tax-funded public welfare sector (e.g., childcare, education and health care), which in Sweden employs numerous women [36]. This could be due to tighter public sector budgets, which put restrictions on pecuniary rewards, decrease job security and reduce esteem rewards at the same time when productivity demands in the production of welfare services increase. Some prospective cohort studies have provided examples of evident associations between ERI and medically certified sick leave for public sector employees [10,34,37–39], while associations were not found in a random working population sample [12].

In conjunction with dual earner families and women's higher exposure to role conflicts and double burden [40,41], ERI and OC may be important contributors to higher sick leave rates among working women in Sweden and elsewhere [42,43]. Women's higher exposure to psychosocial work factors have recently been reported in a Norwegian study as contributing significantly to higher levels of sick leave among the women [44]. In a Canadian study, both work stress and imbalance between work and family life have been associated with mood and anxiety disorders [45]. Since women account

for more than 2 out of 3 persons on sick leave in Sweden, sick leave is indeed a gender-related issue [19]. Swedish labour market is also highly gender-segregated from an international perspective with the majority of women employed in the public welfare sector [36]. Therefore, when analysing the associations between ERI and long-term sick leave it is relevant to expand the analysis with a distinct treatment of gender as well as employment sector.

In addition, there are well-known socioeconomic differences in both exposure to adverse working conditions and health-related outcomes and work ability [46,47]; and the socioeconomic status is probably a relevant link between adverse psychosocial work factors and a worker's health [8], both as a potential mediating and moderating factor [48]. As very few studies have addressed the differences in the effects of ERI in different socioeconomic strata on the labour market [48], such contributions would be valuable.

Aim

The aim of the study was to investigate if effort–reward imbalance (ERI) and overcommitment (OC) are associated with all-cause and mental disorder long-term sick leave (LS) in a random working population sample. Another objective was to identify differences in associations between genders, between private vs. public sector employees and socioeconomic differences due to educational attainment. Stronger associations with LS were expected for mental disorders than all-cause sick leave. The analyses regarding gender, sector and educational attainment were exploratory in character since there is a lack of firm theoretical and empirical underpinning for the formulation of explicit hypotheses.

MATERIAL AND METHODS

The data used originate from the second Survey of Health, Working Conditions, Living Conditions and Sick Leave (Hälsa, Arbete, Levnadsförhållanden & Sjukfrånvaro – HALS II) conducted by the National Social Insurance Board in 2005. It is a population-based cross-sectional study with a case-control design. The basic characteristics of the 2 samples constituting the study are summarised in Table 1. The cases on long-term sick leave (LS-sample) were extracted from the original sample of 16 298 individuals aged 20–64 years who had had a medically certified sick leave period with a duration of at least 15 calendar days starting in January 2005. In the study group (cases), 9177 individuals responded and 3477 cases remained after excluding persons with sick leave spells shorter than 60 days, non-employed individuals (463) and cases with missing values on effort–reward or overcommitment (288). These 3477 persons constituted the study group on long-term sick leave.

The control group was a sample from the general population aged 20–64 years. The control group comprised 4993 individuals, of whom 2811 responded to the survey. In both samples, the non-response was higher among the men, people below 40 years of age, immigrants, non-married people, zero or low income groups and people living in urban areas. The 2811 persons from the control group who initially responded were reduced to 2078 cases after excluding non-employed individuals (594) and deleting cases with missing values on effort–reward or overcommitment (139). These 2078 cases constituted the control group and will be referred to as the working population. Data on health, working and living conditions were gathered through a self-administered questionnaire that was distributed in April 2005. In the LS-sample, the respondents were asked about their situation at the onset of their sick leave in January 2005 and in the control group about their current situation in April 2005.

The survey was conducted by Statistics Sweden in accordance with this authority's ethical guidelines and the Helsinki Declaration including informed consent by all the participants in the study.

Table 1. Study characteristics for the study group (persons on long-term sick leave > 59 days) and the control group in the second Survey of Health, Working Conditions, Living Conditions and Sick Leave (HALS II)

Characteristics	Long-term sick leave (study group)	Working population (control group)
Data collection method for predictors and confounders[a]	self-administered postal questionnaire	self-administered postal questionnaire
Respondents [n]	16 298	4 993
responded to the survey [n]	9 177	2 811
response rate [%]	56.3	56.3
excluded cases due to [n]:		
sick leave < 60 days in March 2005	4 949	–
unemployment and missing values on predictor variables (ERI and OC)	751	733
Observations available for the analysis [n]	3 477	2 078
women [%]	67.4	52.6

[a] Except for age, sex and occupation originating from public statistic records.
ERI – effort–reward imbalance; OC – overcommitment.

Measures

Long-term sick leave (LS)

Medically certified sick leave with a duration of 60 calendar days or more and a diagnosis (International Statistical Classification of Diseases and Related Health Problems, 10th revision – ICD-10) were gathered from the Swedish national social insurance registers.

Predictors

Effort–reward imbalance and overcommitment were measured by the Swedish version of the short form (23 items) of effort–reward imbalance questionnaire, and quartiles were calculated both for ERI and OC in accordance with previous recommendations [49]. The factorial validity of the theoretically based structure of the ERI scale has been confirmed across various samples and repeated measurements [50]. The item on physically demanding work was omitted from the effort index as suggested [49]. The coefficient α reliability for the remaining 5 items was 0.74 for the men and 0.76 for the women. For reward, the coefficient α reliability for the 11 items was 0.83 for the men and 0.81 for the women. Finally, α for the 6 items constituting overcommitment was 0.85 for the men and 0.87 for the women.

Confounders

In the analysis, associations were adjusted for demographic factors such as age (as a continuous variable), cohabitation and underage children in the household. Socioeconomic and work-related factors were also adjusted for: education (primary, secondary or tertiary), employment status (permanent, temporary or self-employed), occupation (International Standard Classification of Occupations (ISCO-88) major groups), employer category (state, municipality, county council, private enterprises, self-employed and other employers such as non-profit organisations), working hours (part-time, full-time or overtime) and physical work environment exposure.

Physical work environment exposure was measured by creating an index of 5 questions regarding frequency of exposure to hazardous substances, noise and vibrations, heavy lifting, twisted and bent work postures, and repeated or monotonous movements. Responses were given on a 5-point scale ranging from "never" to "many times per

day". For physical work environment exposure, the coefficient α reliability was 0.86 for the men and 0.74 for the women. Mean scores were computed and the physical work environment index was divided in quartiles. Different health-related factors were also accounted for: smoking daily (yes/no), overweight or obesity, and self-rated health 1 year before the survey with the original 10-point scale ranging from a very good to a very bad health status divided in quartiles.

The confounders were gathered through a self-administered questionnaire with exception of age and sex that originated from the social insurance registers held by the Swedish Social Insurance Agency and occupation that originated from the occupational register held by Statistics Sweden. Missing values on confounders were rare but coded as a specific category within each confounder. All the cases with such missing values were included in the analysis. Hence, all available information in the study was utilized. An alternative strategy is to omit all the cases with missing values and this strategy has been also tested giving similar results.

Statistical analysis

The binary logistic regression was used to test the multivariate associations between ERI, OC and all-cause or mental disorder LS. In the binary outcome variable, the subjects in the LS-sample were coded as 1 and the subjects in the working population as 0. Associations are presented as odds ratios (OR) with 95% confidence intervals (CI). The all-cause LS analysis was also stratified by gender and employment sector (public or private) in order to detect gender and sector-specific associations. Public sector contained the following categories: state, municipality and county council employment. Private sector contained private employees, self-employed and individuals working for other employers such as non-profit organisations. Further, associations were assessed between ERI, OC and mental disorder LS. The same outcome was also analysed by sector with different ERI components as predictors. Finally, ERI, OC and mental disorder LS were analysed stratified by education (tertiary vs. primary or secondary). The stratified analyses give information of whether variables are more or less significant across the strata and if the direction of the associations is the same. Comparisons of odds ratios across the strata should, however, be made with caution since the analysis does not provide a formal test of interaction. Still, as the same set of variables has been used in all the regression models, the problem with across strata comparisons is reduced.

RESULTS

Characteristics of the study participants are presented in Table 2. Both ERI and OC were more common in the LS-group than in the working population for both the women and men. In the LS-group, the subjects were older, more often lived alone and without underage children in the household. They also had less formal education, were more often permanently employed, worked more often in male dominated blue collar occupations (men) or in the female dominated public sector (women), had higher physical work environment exposures, had worse self-rated health and less favourable health behaviour indicators.

Table 3 presents associations with all-cause LS. Crude associations were found for both ERI and OC for both genders. After adjustment, only the association for the women with high ERI remained significant with OR = 1.58 (95% CI: 1.2–2.08).

In Table 4, the associations for mental disorder LS are presented. Among the women, 594 subjects of the 2345 in the LS-sample had a mental disorder LS and among the men, 210 of 1132 subjects. Both the crude and adjusted associations were considerably stronger for mental disorders than for all-cause LS. The associations were evident for both genders and both high ERI and high OC were strongly associated with mental disorder LS.

Table 2. Characteristics of the study group (persons on long-term sick leave > 59 days) and the control group in the second Survey of Health, Working Conditions, Living Conditions and Sick Leave (HALS II)[a]

Variable	Respondents (N = 5 555)			
	women		men	
	long-term sick leave (study group) (N = 2 345)	working population (control group) (N = 1 092)	long-term sick leave (study group) (N = 1 132)	working population (control group) (N = 986)
Effort–reward imbalance (ERI) (quartiles) [n (%)]				
low	482 (21)	308 (28)	292 (26)	272 (28)
moderately low	538 (23)	277 (25)	270 (24)	286 (29)
moderately high	599 (26)	307 (28)	268 (24)	248 (25)
high	726 (31)	200 (18)	302 (27)	180 (18)
Overcommitment (OC) (quartiles) [n (%)]				
low	468 (20)	237 (22)	270 (24)	256 (26)
moderately low	617 (26)	348 (32)	288 (25)	308 (31)
moderately high	417 (18)	228 (21)	246 (22)	202 (20)
high	843 (36)	279 (26)	328 (29)	220 (22)
Age [years] (M±SD)	46.8±11.3	44.8±11.3	49.8±10.9	45.8±11.4
Cohabitation [n (%)]				
married or living with a partner	1 742 (75)	830 (77)	842 (75)	763 (79)
single living	593 (25)	254 (23)	284 (25)	206 (21)
Children < 18 years living in the family [n (%)]				
no children	1 329 (58)	607 (56)	744 (67)	555 (58)
1 child	403 (18)	182 (17)	140 (13)	125 (13)
2 children	406 (18)	218 (20)	147 (13)	207 (22)
≥ 3 children	157 (7)	68 (6)	76 (7)	75 (8)
Education [n (%)]				
primary	535 (23)	187 (17)	420 (37)	204 (21)
secondary	891 (38)	427 (39)	487 (43)	443 (45)
tertiary	914 (39)	473 (44)	223 (20)	338 (34)
Employment status [n (%)]				
permanent	2 137 (91)	921 (85)	975 (86)	802 (82)
temporary	135 (6)	103 (9)	36 (3)	47 (5)
self employed	67 (3)	64 (6)	117 (10)	134 (14)

Table 2. Characteristics of the study group (persons on long-term sick leave > 59 days) and the control group in the second Survey of Health, Working Conditions, Living Conditions and Sick Leave (HALS II)[a] – cont.

Variable	Respondents (N = 5 555)			
	women		men	
	long-term sick leave (study group) (N = 2 345)	working population (control group) (N = 1 092)	long-term sick leave (study group) (N = 1 132)	working population (control group) (N = 986)
Occupation (ISCO-88 major groups) [n (%)]				
1. Legislators, senior officials and managers	68 (3)	33 (3)	67 (7)	54 (6)
2. Professionals	457 (20)	180 (18)	136 (13)	158 (18)
3. Technicians and associate professionals	485 (22)	194 (19)	168 (16)	176 (20)
4. Clerks	254 (11)	144 (14)	60 (6)	53 (6)
5. Service workers and shop and market sales workers	678 (30)	278 (28)	70 (7)	133 (15)
6. Skilled agricultural and fishery workers	7 (0)	6 (1)	30 (3)	13 (1)
7. Craft and related trades workers	34 (2)	45 (4)	216 (21)	119 (13)
8. Plant and machine operators and assemblers	111 (5)	62 (6)	218 (21)	131 (15)
9. Elementary occupations	155 (7)	66 (7)	61 (6)	51 (6)
Sector of employment [n (%)]				
private	862 (37)	510 (47)	879 (78)	773 (78)
public	1 483 (63)	582 (53)	253 (22)	213 (22)
Work time [n (%)]				
part-time (< 35 h/week)	588 (25)	295 (27)	93 (8)	66 (7)
full-time (35–45 h/week)	1 601 (69)	706 (65)	845 (75)	730 (74)
overtime (> 45 h/week)	146 (6)	85 (8)	191 (17)	188 (19)
Physical work environment exposure (quartiles) [n (%)]				
low	453 (19)	320 (29)	173 (15)	235 (24)
moderately low	564 (24)	326 (30)	180 (16)	228 (23)
moderately high	797 (34)	289 (26)	291 (26)	268 (27)
high	531 (23)	157 (14)	488 (43)	255 (26)
Smoking [n (%)]				
smoking daily	471 (20)	192 (18)	194 (17)	118 (12)
non-smoker	1 860 (80)	894 (82)	922 (83)	860 (88)
Body mass index [n (%)]				
normal weight (< 25 kg/m^2)	1 295 (57)	671 (62)	395 (35)	423 (43)
overweight (25–30 kg/m^2)	689 (30)	270 (25)	553 (49)	440 (45)
obesity (> 30 kg/m^2)	304 (13)	135 (13)	176 (16)	115 (12)

Table 2. Characteristics of the study group (persons on long-term sick leave > 59 days) and the control group in the second Survey of Health, Working Conditions, Living Conditions and Sick Leave (HALS II)[a] – cont.

Variable	Respondents (N = 5 555)			
	women		men	
	long-term sick leave (study group) (N = 2 345)	working population (control group) (N = 1 092)	long-term sick leave (study group) (N = 1 132)	working population (control group) (N = 986)
Self-rated health 1 year before the survey (quartiles) [n (%)]				
bad	564 (24)	126 (12)	306 (27)	79 (8)
moderately bad	455 (20)	116 (11)	215 (19)	130 (13)
moderately good	657 (28)	357 (33)	318 (28)	326 (33)
excellent	648 (28)	486 (45)	290 (26)	447 (46)

[a] The total number of observations summarised over variable categories may vary due to a varying number of missing values. Percentage proportions calculated within valid categories.
M – mean; SD – standard deviation; ISCO-88 – International Standard Classification of Occupations.

Table 3. Associations between effort–reward imbalance, overcommitment and all-cause long-term sick leave

Variable	All-cause long-term sick leave[a]			
	women (N = 3 437)		men (N = 2 118)	
	crude OR (95% CI)	adjusted OR (95% CI)	crude OR (95% CI)	adjusted OR (95% CI)
Effort–reward imbalance (ERI) (quartiles)				
low	1.00	1.00	1.00	1.00
moderately low	1.24 (1.01–1.52)	1.13 (0.91–1.42)	0.88 (0.70–1.11)	0.84 (0.64–1.10)
moderately high	1.25 (1.02–1.52)	1.01 (0.80–1.28)	1.01 (0.79–1.28)	0.92 (0.68–1.23)
high	2.32 (1.88–2.87)	1.58 (1.20–2.08)	1.56 (1.22–2.00)	1.22 (0.87–1.70)
Overcommitment (OC) (quartiles)				
low	1.00	1.00	1.00	1.00
moderately low	0.90 (0.73–1.10)	0.80 (0.64–1.01)	0.89 (0.70–1.12)	0.94 (0.72–1.24)
moderately high	0.93 (0.74–1.16)	0.72 (0.56–0.94)	1.16 (0.90–1.49)	1.23 (0.90–1.68)
high	1.53 (1.24–1.88)	1.00 (0.77–1.31)	1.41 (1.11–1.80)	1.27 (0.91–1.78)

[a] Adjusted model with odds ratios adjusted for demographic characteristics (age, cohabitation and children in the family), socioeconomic and work characteristics (education, occupation, employment status, employer category, hours worked and physical work environment exposure) and health related factors (smoking, body mass index (BMI) and self-reported health).
OR – odds ratio; CI – confidence interval.

Table 4. Associations between effort–reward imbalance, overcommitment and mental disorder long-term sick leave

Variable	Mental disorder long-term sick leave[a]			
	women (N = 1 712)		men (N = 1 200)	
	crude OR (95% CI)	adjusted OR (95% CI)	crude OR (95% CI)	adjusted OR (95% CI)
Effort–reward imbalance (ERI) (quartiles)				
low	1.00	1.00	1.00	1.00
moderately low	1.74 (1.22–2.47)	1.30 (0.87–1.94)	1.08 (0.64–1.81)	0.87 (0.47–1.60)
moderately high	2.44 (1.76–3.40)	1.32 (0.88–1.97)	1.86 (1.15–3.02)	1.03 (0.56–1.92)
high	7.22 (5.22–9.97)	2.76 (1.81–4.20)	4.99 (3.18–7.82)	2.18 (1.16–4.09)
Overcommitment (OC) (quartiles)				
low	1.00	1.00	1.00	1.00
moderately low	1.56 (1.07–2.26)	1.13 (0.74–1.72)	1.28 (0.73–2.25)	1.13 (0.60–2.14)
moderately high	2.36 (1.61–3.45)	1.36 (0.86–2.11)	2.82 (1.65–4.82)	2.11 (1.09–4.08)
high	6.03 (4.27–8.52)	2.82 (1.81–4.39)	5.76 (3.52–9.43)	2.92 (1.49–5.72)

[a] Adjusted model with odds ratios adjusted for demographic characteristics (age, cohabitation and children in the family), socioeconomic and work characteristics (education, occupation, employment status, employer category, hours worked and physical work environment exposure) and health related factors (smoking, body mass index (BMI) and self-reported health).
Abbreviations as in Table 3.

Associations in different strata of the working population

Effort–reward imbalance and overcommitment were fairly evenly distributed across genders and sectors with an evident exception of significantly higher ERI reported by the women working in public sector. In particular, high efforts were more common among the women in public sector, while low job promotion was reported by both the women and men with public sector employment.

Even though the prevalence of ERI was higher among the women in public sector, the association with all-cause LS was not stronger for the women in public sector with OR = 1.49 (95% CI: 1.04–2.15) than for the women in private sector with OR = 1.82 (95% CI: 1.18–2.78). Since all the other results from the analysis of all-cause LS stratified by gender and sector were insignificant, they are not presented in detail. Still, with mental disorder LS as the outcome, the association among the women was driven by different mechanisms in public and private sectors (Table 5). Among the women in public sector, the association for ERI was driven by low job esteem and among the women in private sector by low job security. Among the men, the association with mental disorder LS was driven by high effort in both public and private sectors.

Finally, socioeconomic differences in the associations with mental disorder LS are presented in Table 6, where the sample is divided by educational attainment. Among both the women and men with less formal education, both high ERI (especially for the men) and high OC (especially for the women) were associated with mental disorder LS. Among the women with higher education, even moderate levels of ERI were associated with mental disorder LS, which was further exacerbated with higher levels of ERI. Among the men with higher education, the association was instead evident for high OC, which was considerably associated with mental disorder LS.

Table 5. Associations between components of effort–reward imbalance (ERI) and mental disorder long-term sick leave by sector

ERI component	Mental disorder long-term sick leave[a]			
	women (N = 1 651)		men (N = 1 174)	
	public sector (N = 960)	private sector (N = 691)	public sector (N = 266)	private sector (N = 908)
Job effort (Me)				
low (OR_{adj})	1.00	1.00	1.00	1.00
high (OR_{adj} (95% CI))	1.33 (0.93–1.90)	1.50 (0.90–2.50)	2.90 (1.06–7.94)	1.89 (1.12–3.17)
Job esteem (Me)				
high (OR_{adj})	1.00	1.00	1.00	1.00
low (OR_{adj} (95% CI))	1.68 (1.19–2.37)	1.13 (0.69–1.85)	1.38 (0.52–3.66)	1.56 (0.95–2.58)
Job security (Me)				
high (OR_{adj})	1.00	1.00	1.00	1.00
low (OR_{adj} (95% CI))	1.22 (0.87–1.69)	1.69 (1.09–2.62)	2.01 (0.72–5.60)	1.14 (0.71–1.84)
Job promotion (Me)				
high (OR_{adj})	1.00	1.00	1.00	1.00
low (OR_{adj} (95% CI))	0.92 (0.64–1.32)	1.08 (0.68–1.71)	1.10 (0.40–3.08)	0.56 (0.35–0.90)

Me – median; OR_{adj} – adjusted odds ratio; CI – confidence interval.
[a] Odds ratios adjusted for demographic characteristics (age, cohabitation, children in the family), socioeconomic and work characteristics (education, occupation, employment status, hours worked and physical work environment exposure), overcommitment and health related factors (smoking, body mass index (BMI) and self-reported health).

Table 6. Associations between effort–reward imbalance, overcommitment and mental disorder long-term sick leave

Variable	Mental disorder long-term sick leave[a]			
	women (N = 1 707)		men (N = 1 199)	
	primary/secondary education (N = 931)	tertiary education (N = 776)	primary/secondary education (N = 783)	tertiary education (N = 416)
Effort–reward imbalance (ERI) (quartiles)				
low (OR_{adj})	1.00	1.00	1.00	1.00
moderately low (OR_{adj} (95% CI))	1.15 (0.70–1.90)	2.22 (1.04–4.78)	1.26 (0.58–2.74)	0.37 (0.12–1.17)
moderately high (OR_{adj} (95% CI))	1.07 (0.64–1.78)	2.83 (1.32–6.06)	1.57 (0.72–3.43)	0.48 (0.15–1.57)
high (OR_{adj} (95% CI))	1.88 (1.09–3.26)	6.94 (3.20–15.04)	3.65 (1.60–8.36)	0.99 (0.31–3.15)
Overcommitment (OC) (quartiles)				
low (OR_{adj})	1.00	1.00	1.00	1.00
moderately low (OR_{adj} (95% CI))	1.42 (0.84–2.40)	0.62 (0.29–1.34)	1.31 (0.60–2.86)	0.90 (0.25–3.23)
moderately high (OR_{adj} (95% CI))	1.63 (0.92–2.89)	0.86 (0.39–1.87)	2.16 (0.95–4.88)	2.41 (0.65–8.93)
high (OR_{adj} (95% CI))	3.57 (2.01–6.34)	1.80 (0.83–3.91)	2.18 (0.96–4.94)	5.79 (1.48–22.57)

Abbreviations as in Table 5.
[a] Odds ratios adjusted for demographic characteristics (age, cohabitation and children in the family), socioeconomic and work characteristics (occupation, employment status, employer category, hours worked and physical work environment exposure) and health related factors (smoking, body mass index (BMI) and self-reported health).

DISCUSSION

Effort–reward imbalance (ERI) was associated with all-cause long-term sick leave (LS) exceeding 2 months among the women, but not among the men, irrespective of their employment sector. This is in line with the findings from the Whitehall II study of British civil servants [10], cohort studies of Dutch teachers [38] and Belgian nurses [39], and Swedish cross-sectional findings [15]. There was a bivariate association for the men but it diminished after adjustment for confounding factors. Regarding overcommitment (OC), no independent association with all-cause LS was found.

Since adjustments were made for a large number of demographic, work and health related factors (all in all 11 factors), the presented associations should be considered as conservative estimates. As a comparison, the Whitehall study adjusted for 3 confounding factors [10] so over-adjustment cannot be ruled out in the current study. Another source of underestimation of associations is that the "working population" group also contained some subjects on long-term sick leave.

Associations for mental disorder LS were evident for both ERI and OC among both genders. This is in line with the growing evidence of the negative impact of adverse psychosocial work situations on mental health and work ability in general [29–32], and medically certified sick leave [33,34] or disability pension [35] for mental disorders in particular.

In the current study, for the men, the association with mental disorder LS was driven by high effort, while for the women the driving factors were: low job esteem in public sector and low job security in private sector. Even though Swedish women's participation in paid labour is high by international standards, Swedish labour market is still highly gender segregated, both horizontally and vertically [36]. Large numbers of Swedish women work in publicly funded services such as education, health care, childcare and care of the elderly with evident high exposures to adverse psychosocial working conditions [18]. In publicly funded occupations such as teachers, nurses and social workers, it is also plausible that job esteem plays a more significant role than job promotion [7]. Vertical gender segregation with fewer women in managing positions, lower wages and more precarious employment among women [36] may explain the association between low work security and mental disorder sick leave among the women in private sector.

The male-breadwinner society has changed to a dual earner norm in Sweden but still, working women do more unpaid work and take greater responsibility for family and children [36], resulting in higher reports of exposure to role conflicts and double burden [40,41]. Hence, men are still to a higher extent supposed to compete successfully on the labour market [40,41], which may explain why the association between ERI and mental disorder LS is driven by high effort among men.

The reports of gender differences of ERI associations and sick leave are very scarce, but a Canadian cohort study of office workers has reported that low rewards among men and ERI among women were associated with medically certified sick leave for mental disorders exceeding 4 days [34]. In the current study, both ERI and OC were associated with mental disorder LS among the women and men with lower education, but stronger associations were found among those with high educational attainment. For the women with high education, ERI was strongly related to mental disorder LS, while for the men with high education, OC was strongly related to the same outcome.

Interpretation of the results regarding effort reward imbalance and its association with long-term sick leave in a Swedish context can be summed up as follows. Effort–reward imbalance is a more pertinent risk factor for all-cause sick leave among women with somewhat higher exposure among women in the working population. There are no evident differences in the overall associations between public and private sector employees but exposure

to high efforts and low job promotion is higher in public sector, especially among the women. For mental disorder sick leave, the associations are evident for both the women and men with overcommitment as a particular risk factor. The most pertinent ERI components among women are low job esteem in public sector and low job security in private sector. Hence, mental health of women working with the provision of welfare services is hampered by the lack of appreciation for their efforts in their work, while mental health of women working in private sector is mostly affected by anxiety over their more precarious position in the labour market [36]. Both situations can be understood by applying the prevailing gender norm context where women are expected to take the major responsibility for the caring needs in society [42,44,45].

Even though gender norms are gradually changing over time and space, women are still to a high degree employed in public welfare services and hold less favourable positions in the male-dominated market competitive private sector [36]. Men, on the other hand, are assumed to successfully compete for higher rank positions [42,44,45], which may explain why high effort at work is a particular mental health risk factor for the men in both public and private sectors in the current study.

Gender differences regarding psychosocial factors associated with mental disorder sick leave among highly educated respondents may also be understood by prevailing anticipations of gender division of labour [36,42,44,45]. According to the results of the current study, mental health among the highly educated men may be hampered by the lack of restraining factors, e.g., other roles beside the work role leading to problematic overcommitment at work. Among the highly educated women too many restraining factors, e.g., "glass ceilings" at work and family–work interference may lead to subordinate work positions and problematic imbalance between efforts, and rewards at work, which, in turn, negatively affect mental health and work ability.

Previous research that used the DC model [1] has given incongruent results for women with active jobs with an increased risk of sick leave in contradiction with the "active learning hypothesis" [13,14]. The DC model also seems to be more suitable for predicting LS within private sector than in public sector, which employs a large proportion of working women [13]. In contrast, the current study indicates that the ERI model could increase our understanding of different mechanisms lying behind the lack of reciprocity in the work environment leading to emotional distress and lengthy sick leave in public and private sector jobs [7]. For the women in public sector, lengthy sick leave due to mental disorders was driven by low job esteem, while for the women in private sector, the driving factor was low job security.

Overall, the ERI model seems to be a stronger predictor for LS among women. However, with mental disorder sick leave as an outcome, associations with ERI were evident for both the women and men. The independent role of overcommitment in predicting mental disorder LS should be also emphasized, especially among the highly educated men. Work ability of the highly educated women, on the other hand, seems to be more strongly hampered by effort–reward imbalance. In advanced societies, these results add to our understanding both regarding an increase of sick leave due to mental disorders and the prevailing gender gap in sick leave.

Strengths and limitations

A major strength of the current study is the large working population-based study sample, which enables broad generalization across occupations and employment sectors for the Swedish and Nordic contexts with similar sickness insurance systems. The data set also has a reasonably high level of validity and reliability in the sense that it contains well measured indicators of all the explanations conventionally used for sick leave. The fact that the outcome variable is measured through registers is also an advantage.

Another advantage with the cross-sectional design is that the problem with eroding samples due to low response rates in longitudinal studies is reduced.

The study has some obvious limitations, and causality is always an issue when using a cross-sectional design. Still, the results are in line with the theoretical foundations of the ERI model and the few previous cohort studies with sick leave as an outcome [10,11,34]. The differences between genders employment sectors and socioeconomic groups should be interpreted with caution since no formal statistical test of the possible interaction effects has been made in this study.

The retrospective approach regarding self-reported psychosocial work environment could also pose problems with reversed aetiology. However, there is support for the proposition that this is not a major problem in a Swedish setting [51]. Still, a German study of white-collar workers aged 45–59 years indicates that reduced work ability may in itself increase ERI [52], which potentially further decreases work ability and increases the risk of LS among senior workers. In the current study, extensive adjustment for potentially confounding factors was made, including self-rated health and lifestyle factors, which should reduce potential bias due to reversed causality.

CONCLUSIONS

With long-term sick leave as an outcome, the study confirmed the independent roles of effort–reward imbalance and overcommitment, with stronger associations found among women and for mental disorders. The use of the ERI model in sick leave research appears to be a promising contribution to understanding the prevailing gender gap in sick leave and, particularly, the increasing sick leave rates due to mental disorders in a modern work life.

The results from the current study contribute to the literature regarding potentially different mechanisms in different strata of the working population. Gender, employment sector and socioeconomic status appear to be important factors regarding psychosocial work environment and its health implications. Still, there is a need for more longitudinal studies of ERI and worker health in both Swedish and international contexts.

REFERENCES

1. Karasek R. Job demands, job decision latitude and mental strain: Implications for job redesign. Adm Sci Q. 1979;24(2):285–308, http://dx.doi.org/10.2307/2392498.
2. Karasek R, Theorell T. Healthy work: Stress, productivity, and the reconstruction of working life. New York: Basic Books; 1990.
3. Allebeck P, Mastekaasa A. Chapter 5. Risk factors for sick leave – General studies. Scand J Public Health. 2004;32 (Suppl 63):49–108, http://dx.doi.org/10.1080/14034950410021853.
4. Siegrist J. Adverse health effects of high-effort/low-reward conditions. J Occup Health Psychol. 1996;1(1):27–41, http://dx.doi.org/10.1037/1076-8998.1.1.27.
5. Kuper H, Singh-Manoux A, Siegrist J, Marmot M. When reciprocity fails: Effort–reward imbalance in relation to coronary heart disease and health functioning within the Whitehall II study. Occup Environ Med. 2002;59(11):777–84, http://dx.doi.org/10.1136/oem.59.11.777.
6. De Jonge J, Bosma H, Peter R, Siegrist J. Job strain, effort-reward imbalance and employee well-being: A large-scale cross-sectional study. Soc Sci Med. 2000;50(9):1317–27, http://dx.doi.org/10.1016/S0277-9536(99)00388-3.
7. Marshall NL, Barnett RC, Sayer A. The changing workforce, job stress, and psychological distress. J Occup Health Psychol. 1997;2(2):99–107, http://dx.doi.org/10.1037/1076-8998.2.2.99.
8. Siegrist J. Work, health and welfare: New challenges. Int J Soc Welf. 2006;15 Suppl 1:S5–12, http://dx.doi.org/10.1111/j.1468-2397.2006.00439.x.
9. Tsutsumi A, Kawakami N. A review of empirical studies on the model of effort–reward imbalance at work: Reducing occupational stress by implementing a new theory. Soc Sci Med. 2004;59(11):2335–59, http://dx.doi.org/10.1016/j.socscimed.2004.03.030.

10. Head J, Kivimäki M, Siegrist J, Ferrie JE, Vahtera J, Shipley MJ, et al. Effort–reward imbalance and relational injustice at work predict sickness absence: The Whitehall II study. J Psychosom Res. 2007;63(4):433–40, http://dx.doi.org/10.1016/j.jpsychores.2007.06.021.
11. Roelen CA, Koopmans PC, Groothoff JW. Occupational rewards relate to sickness absence frequency but not duration. Work. 2009;34(1):13–9, http://dx.doi.org/10.3233/WOR-2009-0898.
12. Nielsen MB, Madsen IE, Bultmann U, Aust B, Burr H, Rugulies R. Effort-reward imbalance at work and risk of long-term sickness absence in the Danish workforce. J Occup Environ Med. 2013;55(4):454–9, http://dx.doi.org/10.1097/JOM.0b013e31827dba5b.
13. Lidwall U, Marklund S. What is healthy work for women and men? – A case-control study of gender- and sector-specific effects of psycho-social working conditions on long-term sickness absence. Work. 2006;27(2):153–63.
14. Krantz G, Ostergren PO. Do common symptoms in women predict long spells of sickness absence? A prospective community-based study on Swedish women 40 to 50 years of age. Scand J Public Health. 2002;30(3):176–83, http://dx.doi.org/10.1080/14034940210133816.
15. Fahlen G, Goine H, Edlund C, Arrelov B, Knutsson A, Peter R. Effort-reward imbalance, "locked in" at work, and long-term sick leave. Int Arch Occup Environ Health. 2009;82(2):191–7, http://dx.doi.org/10.1007/s00420-008-0321-5.
16. Lidwall U, Marklund S. Trends in long-term sickness absence in Sweden 1992–2008: The role of economic conditions, legislation, demography, work environment and alcohol consumption. Int J Soc Welf. 2011;20(2):167–79, http://dx.doi.org/10.1111/j.1468-2397.2010.00744.x.
17. Lidwall U, Bergendorff S, Voss M, Marklund S. Long-term sickness absence: Changes in risk factors and the population at risk. Int J Occup Med Environ Health. 2009;22(2):157–68, http://dx.doi.org/10.2478/v10001-009-0018-3.
18. The Swedish Work Environment Authority. Arbetsmiljön 2013. The Work Environment 2013. Arbetsmiljöstatistik Rapport 2014:3. Stockholm: Arbetsmiljöverket; 2013.
19. Försäkringskassan. Social insurance in figures 2014. Stockholm: Försäkringskassan; 2014.
20. Organization for Economic Co-operation and Development. Sickness, disability and work. Breaking the barriers. A synthesis of findings across OECD countries. Paris: OECD Publishing; 2010.
21. Organization for Economic Co-operation and Development. Mental health and work: Sweden. Paris: OECD Publishing; 2013, http://dx.doi.org/10.1787/9789264188730-en.
22. Kivimäki M, Head J, Ferrie J, Shipley M, Vahtera J, Marmot M. Sickness absence as a global measure of health: Evidence from mortality in the Whitehall II prospective cohort study. BMJ. 2003;327(7411):364–9, http://dx.doi.org/10.1136/bmj.327.7411.364.
23. Marmot M, Feeney A, Shipley M, North F, Syme SL. Sickness absence as a measure of health status and functioning: From the UK Whitehall II study. J Epidemiol Community Health. 1995;49(2):124–30, http://dx.doi.org/10.1136/jech.49.2.124.
24. Vahtera J, Pentti J, Kivimaki M. Sickness absence as a predictor of mortality among male and female employees. J Epidemiol Community Health. 2004;58(4):321–6, http://dx.doi.org/10.1136/jech.2003.011817.
25. Alexanderson K, Norlund A. Sickness absence: Causes, consequences, and physicians' sickness certification practice. A systematic literature review by the Swedish Council on Technology Assessment in Health Care (SBU). Scand J Public Health. 2004;32(Suppl 63):3–263, http://dx.doi.org/10.1080/14034950410003826.
26. Lidwall U. Sick leave diagnoses and return to work: A Swedish register study. Disabil Rehabil. 2015;37(5):396–410, http://dx.doi.org/10.3109/09638288.2014.923521.
27. Lidwall U. Long-term sickness absence. Aspects of society, work, and family [dissertation] [Internet]. Stockholm: Karolinska Institutet; 2010 [cited 2015 May 16]. Available from: https://openarchive.ki.se/xmlui/bitstream/handle/10616/38927/thesis.pdf?sequence=1.
28. Hensing G. Chapter 4. Methodological aspects in sickness-absence research. Scand J Public Health. 2004;

32(Suppl 63):44–8, http://dx.doi.org/10.1080/14034950410021844.

29. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environment and stress-related disorders, a systematic review. Occup Med (Lond). 2010;60(4):277–86, http://dx.doi.org/10.1093/occmed/kqq081.
30. Siegrist J. Chronic psychosocial stress at work and risk of depression: Evidence from prospective studies. Eur Arch Psychiatry Clin Neurosci. 2008;258 Suppl 5:115–9, http://dx.doi.org/10.1007/s00406-008-5024-0.
31. Stansfeld S, Candy B. Psychosocial work environment and mental health – A meta-analytic review. Scand J Work Environ Health. 2006;32(6):443–62, http://dx.doi.org/10.5271/sjweh.1050.
32. Bethge M, Radoschewski FM. Adverse effects of effort–reward imbalance on work ability: Longitudinal findings from the German Sociomedical Panel of Employees. Int J Public Health. 2012;57(5):797–805, http://dx.doi.org/10.1007/s00038-011-0304-2.
33. Janssens H, Clays E, de Clercq B, Casini A, de Bacquer D, Kittel F, et al. The relation between psychosocial risk factors and cause-specific long-term sickness absence. Eur J Public Health. 2014;24(3):428–33, http://dx.doi.org/10.1093/eurpub/cku009.
34. Ndjaboue R, Brisson C, Vezina M, Blanchette C, Bourbonnais R. Effort–reward imbalance and medically certified absence for mental health problems: A prospective study of white-collar workers. Occup Environ Med. 2014;71(1):40–7, http://dx.doi.org/10.1136/oemed-2013-101375.
35. Juvani A, Oksanen T, Salo P, Virtanen M, Kivimäki M, Pentti J, et al. Effort-reward imbalance as a risk factor for disability pension: The Finnish Public Sector Study. Scand J Work Environ Health. 2014;40(3):266–77, http://dx.doi.org/10.5271/sjweh.3402.
36. Women and men in Sweden 2014. Facts and figures. Statistics Sweden 2014. Örebro: Statistics Sweden; 2014.
37. Ala-Mursula L, Vahtera J, Linna A, Pentti J, Kivimaki M. Employee worktime control moderates the effects of job strain and effort-reward imbalance on sickness absence: The 10-town study. J Epidemiol Community Health. 2005;59(10):851–7, http://dx.doi.org/10.1136/jech.2004.030924.
38. Derycke H, Vlerick P, van de Ven B, Rots I, Clays E. The impact of effort–reward imbalance and learning motivation on teachers' sickness absence. Stress Health. 2013;29(1):14–21, http://dx.doi.org/10.1002/smi.2416.
39. Trybou J, Germonpre S, Janssens H, Casini A, Braeckman L, de Bacquer D, et al. Job-related stress and sickness absence among Belgian nurses: A prospective study. J Nurs Scholarsh. 2014;46(4):292–301, http://dx.doi.org/10.1111/jnu.12075.
40. Gjerdingen D, McGovern P, Bekker M, Lundberg U, Willemsen T. Women's work roles and their impact on health, well-being, and career: Comparisons between the United States, Sweden, and The Netherlands. Women Health. 2000;31(4):1–20, http://dx.doi.org/10.1300/J013v31n04_01.
41. Lidwall U, Marklund S, Voss M. Work-family interference and long-term sickness absence: A longitudinal cohort study. Eur J Public Health. 2010;20(6):676–81, http://dx.doi.org/10.1093/eurpub/ckp201.
42. Bekker MH, Rutte CG, van Rijswijk K. Sickness absence: A gender-focused review. Psychol Health Med. 2009;14(4):405–18, http://dx.doi.org/10.1080/13548500903012830.
43. Siegrist K, Rodel A, Hessel A, Brahler E. [Psychosocial workload, sick leave, and health-related well being: An empirical study from the perspective of gender research]. Gesundheitswesen. 2006;68(8–9):526–34, http://dx.doi.org/10.1055/s-2006-927073. German.
44. Sterud T. Work-related gender differences in physician-certified sick leave: A prospective study of the general working population in Norway. Scand J Work Environ Health. 2014;40(4):361–9, http://dx.doi.org/10.5271/sjweh.3427.
45. Wang JL. Perceived work stress, imbalance between work and family/personal lives, and mental disorders. Soc Psychiatry Psychiatr Epidemiol. 2006;41(7):541–8, http://dx.doi.org/10.1007/s00127-006-0058-y.

46. Marmot M. The status syndrome: How social standing affects our health and longevity. Henry Holt: New York; 2004.
47. Wahrendorf M, Dragano N, Siegrist J. Social position, work stress, and retirement intentions: A study with older employees from 11 European countries. Eur Sociol Rev. 2013;29(4):792–802, http://dx.doi.org/10.1093/esr/jcs058.
48. Hoven H, Siegrist J. Work characteristics, socioeconomic position and health: A systematic review of mediation and moderation effects in prospective studies. Occup Environ Med. 2013;70(9):663–9, http://dx.doi.org/10.1136/oemed-2012-101331.
49. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, et al. The measurement of effort–reward imbalance at work: European comparisons. Soc Sci Med. 2004;58(8):1483–99, http://dx.doi.org/10.1016/S0277-9536(03)00351-4.
50. Rantanen J, Feldt T, Hyvonen K, Kinnunen U, Makikangas A. Factorial validity of the effort–reward imbalance scale: Evidence from multi-sample and three-wave follow-up studies. Int Arch Occup Environ Health. 2013;86(6):645–56, http://dx.doi.org/10.1007/s00420-012-0798-9.
51. Waldenström K, Lundberg I, Waldenström M, Härenstam A; MOA-Research-Group. Does psychological distress influence reporting of demands and control at work? J Occup Environ Med. 2003;60(11):887–91, http://dx.doi.org/10.1136/oem.60.11.887.
52. Bethge M, Radoschewski FM, Gutenbrunner C. Effort–reward imbalance and work ability: Cross-sectional and longitudinal findings from the Second German Sociomedical Panel of Employees. BMC Public Health. 2012;12(1):875, http://dx.doi.org/10.1186/1471-2458-12-875.