




Injustice at work affects work ability and role functioning: findings of a cohort study

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Abstract

Objectives The aim was to analyze the longitudinal effects of organizational injustice (OIJ) and effort–reward imbalance (ERI) on work ability, emotional role functioning and physical role functioning.

Methods Longitudinal data with a two-year follow-up of people previously receiving sickness absence benefits were used for analyses. OIJ and ERI were included separately and mutually in logistic regression models. Effects were tested for additivity. All analyses were additionally performed stratified by sex. All models were adjusted for sociodemographics and neuroticism.

Results 1886 participants (44.5% men, mean age: 48 years) were included. When mutually adjusted, OIJ and ERI affected work ability, and OIJ affected emotional role functioning. In stratified analyses, OIJ affected all outcomes in women, and ERI affected work ability in men. Additive effects of OIJ and ERI were not identified.

Conclusions OIJ and ERI are important risk factors of limited participation. People with experiences of health-related and work-related impairments are in need of reliable structures and just working conditions.

Keywords Organizational justice · Effort–reward imbalance · Work ability · Role functioning · Longitudinal design

Introduction

Over the last two decades, social epidemiologic research has increasingly focused on justice at work as a determinant of worker's health, employee's satisfaction and job retention (Dragano et al. 2016; Hoven and Siegrist 2013; Ndjaboué et al. 2012). 'Justice' refers to procedural (fairness and the transparency of the processes), relational (fair leadership) and distributive justice (fair allocation of wages and esteem). Procedural and relational justices are commonly summed up under the term 'organizational justice' (Elovainio et al. 2002; Kivimäki et al. 2007; Moorman 1991). Organizational injustice (OIJ) at work is associated with depression (Inoue et al. 2013; Ndjaboué et al. 2012), short and long periods of sickness absence (Hjarsbech et al. 2014; Ybema et al. 2016), sleep disturbance (Linton et al. 2015), burnout (Jin et al. 2015), suicidal thoughts (Loerbroks et al. 2016), pain (Herr et al. 2015), poor work ability (Spanier et al. 2014), coronary heart diseases (Inoue et al. 2015), early retirement (Juvani et al. 2016) and intentions to leave the job (Loerbroks et al. 2014). One of the best known representations of distributive justice is the model of effort–reward imbalance (ERI). The consequences of an ERI for the employees are quite comparable to those of OIJ (Rugulies et al. 2016; Siegrist and Li 2016).

Not all studies that examined both ERI and OIJ showed independent associations of distributive and organizational justice with health outcomes. In most of the studies, the effects were significantly reduced as soon as both OIJ and ERI were considered within one model. This suggests that OIJ and ERI do not represent independent constructs. There is evidence that ERI might be a time-delayed consequence of OIJ, and effects of OIJ are mediated by ERI (Spanier et al. 2014). Moreover, both models are strongly associated with each other. The esteem component of the

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reward scale used in the model of ERI overlaps with relational justice, and restricted promotion opportunities and job insecurity are examples of manifestations of procedural injustice.

However, both models differ conceptually. Perceptions of procedural and relational injustice describe the transparency and order of structures as well as interpersonal interactions in hierarchical structures. The ERI model focuses on the formal or informal contract between the employee and the employer. In this model, OIJ is only relevant if it directly affects the relationship between employee and employer (Kivimäki et al. 2007). It is therefore recommended to consider both OIJ and ERI when examining the effects of unjust work conditions on health (Hayashi et al. 2015). If OIJ and ERI are different, complementary concepts, independent and additive effects should be observable if both risks occur at the same time (Kivimäki et al. 2007).

The purpose of our study was twofold: first, to investigate the independent effects of OIJ and ERI on work ability, emotional and physical role functioning after a two-year follow-up in a sample of strongly impaired employees. Second, to assess whether both risk factors has an additive effect on the dependent variables.

Methods

The Third German Sociomedical Panel of Employees (GSPE-III) investigates determinants of work ability, rehabilitation utilization, and disability pension in employees (Bethge et al. 2015). The sample includes 10,000 persons who were randomly selected from the Federal German Pension Insurance register. The sample was restricted to persons from 40 to 54 years of age who had received sickness absence benefits in 2012. The baseline questionnaires were sent in 2013; the follow-up was established in 2015. In the case of non-return, people were sent a reminder 6 weeks later. Only persons who were employed at both measurement points were considered in our analysis. The GSPE-III was registered in the German Clinical Trials Register (DRKS00004824).

Outcomes

Work Ability Index

The Work Ability Index (WAI) assesses a person's ability to manage his or her job demands in consideration of their current state of health (Ilmarinen 2009). The WAI yields a continuous score, ranging from 7 to 49 points, with higher scores indicating better work ability. WAI scores can be classified into four categories: poor (7–27 points),

moderate (28–36 points), good (37–43 points), and excellent work ability (44–49 points) (Jaaskelainen et al. 2016). For our analyses both upper categories and both lower categories were joined (poor vs. good work ability), and good work ability was chosen as reference.

Emotional and physical role functioning

Emotional and physical role functioning were assessed with the corresponding subscales of the 36-item Short-Form Health Survey (Ware and Sherbourne 1992). These scales assess the extent to which psychological and physiological problems impair working and daily life. The continuous scores of both scales were categorized at the first quartile (poor vs. good role functioning). The cut-off score for emotional role functioning scale was < 33.3 and for the physical role functioning scale < 25.0 . These baseline thresholds were also used for categorizing the role functioning follow-up measurements. Good role functioning was chosen as reference.

Risk factors

Organizational justice

Organizational justice was assessed using a German version of Moorman's "Organizational justice questionnaire (OJQ)" (Elovainio et al. 2002; Moorman 1991), which consists of 13 items within two dimensions: procedural (6 items) and relational justice (7 items) (Spanier et al. 2014). All items were summed and divided by their number. Higher scores represent higher OIJ. For our analyses we categorized the scale at its tertiles (high vs. moderate vs. low OIJ, cut-off scores: high OIJ ≥ 3.5 , moderate OIJ ≥ 2.7). Low OIJ was chosen as reference.

Effort–reward imbalance

ERI was assessed using a short version of the "Effort–Reward Imbalance Questionnaire" (ERIQ). Effort was assessed with three items and reward was assessed with seven items to identify an ERI (Siegrist et al. 2009). Items were answered on a four-point scale. The effort–reward ratio (ER ratio) was calculated using a weighted quotient of the effort and reward items. An ER ratio greater than 1 indicates that efforts outweigh the rewards, which by theory represents an ERI. Recent studies that applied the short version of the ERIQ in their surveys had shown very high prevalence of ERI when using the common threshold of an ER ratio > 1 (Kurioka et al. 2014; Unrath et al. 2012). This short version is not only characterized by fewer items but also has a four-point scale. The study by Kurioka et al. recommends a cut-off > 1.4 to identify an ERI (Kurioka

et al. 2014). We therefore report both the proportion with an ER ratio > 1 and the proportion with ER ratio > 1.4 . The latter threshold is near to our upper tertile of the ER ratio. For our analyses the ER ratio was categorized at its tertiles (high vs. moderate vs. low ER ratio, cut-off scores: high ER ratio ≥ 1.5 , moderate ER ratio ≥ 1.1). Low ER ratio was chosen as reference.

Sociodemographic data

Age (≥ 50 vs. < 50 years), sex (male vs. female), education (lower secondary level or less vs. upper secondary level, i.e., higher education entrance certificates) and partnership (no partner vs. partner) were considered as sociodemographic covariates.

Neuroticism

Neuroticism was assessed by a short version of the Big Five Inventory (Lang et al. 2011). The scale consists of three items, which were summed. For our analyses we categorized the scale at its last tertile (high vs. low neuroticism, cut-off score high neuroticism ≥ 14.0).

Analyses

Sample characteristics were determined by descriptive statistics. Dropouts were analyzed by Chi-squared tests and *t* tests for independent samples. Cronbach's α was calculated to assess internal consistency of multi-item scores.

Logistic regression models were conducted to determine effects of OIJ and ERI on work ability (models 1.1–1.3), emotional (models 2.1–2.3) and physical role functioning (models 3.1–3.3). All predictor variables were obtained from the baseline questionnaire. Dependent variables were taken from the follow-up questionnaire. All models were adjusted for the baseline values of the dependent variables, sociodemographic characteristics, and neuroticism. Initially, the influence of organizational injustice was estimated (models 1.1, 2.1, 3.1). Then, the influence of the ER ratio was determined (models 1.2, 2.2, 3.2). In a third step, both OIJ and the ER ratio were included (model 1.3, 2.3, 3.3). This procedure was chosen to present independent effects of OIJ and the ER ratio. We checked multicollinearity by regressing each independent variable on all other independent variables. There was no hint of multicollinearity. These analyses were performed for the full sample and separately for women and men. Additionally, we tested if associations of OIJ and ER ratio were moderated by sex.

In a further step, the additive interaction between the two main predictors was tested in the fully adjusted model. We calculated the relative excess risk due to interaction

(RERI) (Knol et al. 2011; Rothman 1976) as a measure to prove interaction on an additive scale. Confidence intervals were achieved by bootstrapping (500 replications):

$$\text{RERI} = \text{OR}_{A+B+} - \text{OR}_{A+B-} - \text{OR}_{A-B+} + 1,$$

OR_{A+B+} represents the risk if both risk factors were present. OR_{A+B-} or OR_{A-B+} represent the risk if only one risk factor was present. $\text{RERI} = 0$ means no interaction or exact additivity. $\text{RERI} > 0$ indicates synergy or more than additivity. $\text{RERI} < 0$ means less than additivity or antagonism.

Missing values were imputed using chained equations (Royston and White 2011). Parameters without missing values (age and sex) were included as covariates in the imputation model. Five independent data sets with complete values were created. Parameter estimates were combined in accordance with Rubin's rules (Little and Rubin 2002). Statistical results were regarded as significant if the two-sided *P* value of a test was less than 0.05. All calculations were performed with StataSE version 13.1.

Results

Of the initial 10,000 sent questionnaires, 103 could not be delivered; 3294 questionnaires were returned. First survey data of 311 participants were excluded as they were unemployed, or the information on their employment status was missing. Thirty-six first survey participants were not reached by the follow-up survey, 887 persons did not send back the questionnaire. The remaining sample comprised 2060 participants. Follow-up data of 174 participants were excluded as they were unemployed, or the information on their employment status was missing. Finally, we included 1886 persons in our analysis. Figure 1 shows the participants' flow.

The mean age of the participants was 48 years ($SD = 4.0$), more than half were women (56.5%). Almost a quarter of the people had a higher education entrance certificate (22.9%), more than three quarters lived with a partner (20.5%, Table 1). Non-responders were more often male, somewhat younger, more often had a lower educational level, were more often without a partner, and reported lifestyle health risks more frequently. Responders and non-responders did not differ regarding baseline neuroticism, organizational justice, ERI, subjective work ability, emotional and physical role functioning. We included 1886 participants in the longitudinal analyses.

Effects of organizational justice and effort–reward imbalance on work ability

Without adjusting for the ER ratio, participants with high OIJ had 1.91 times higher odds of poor work ability in

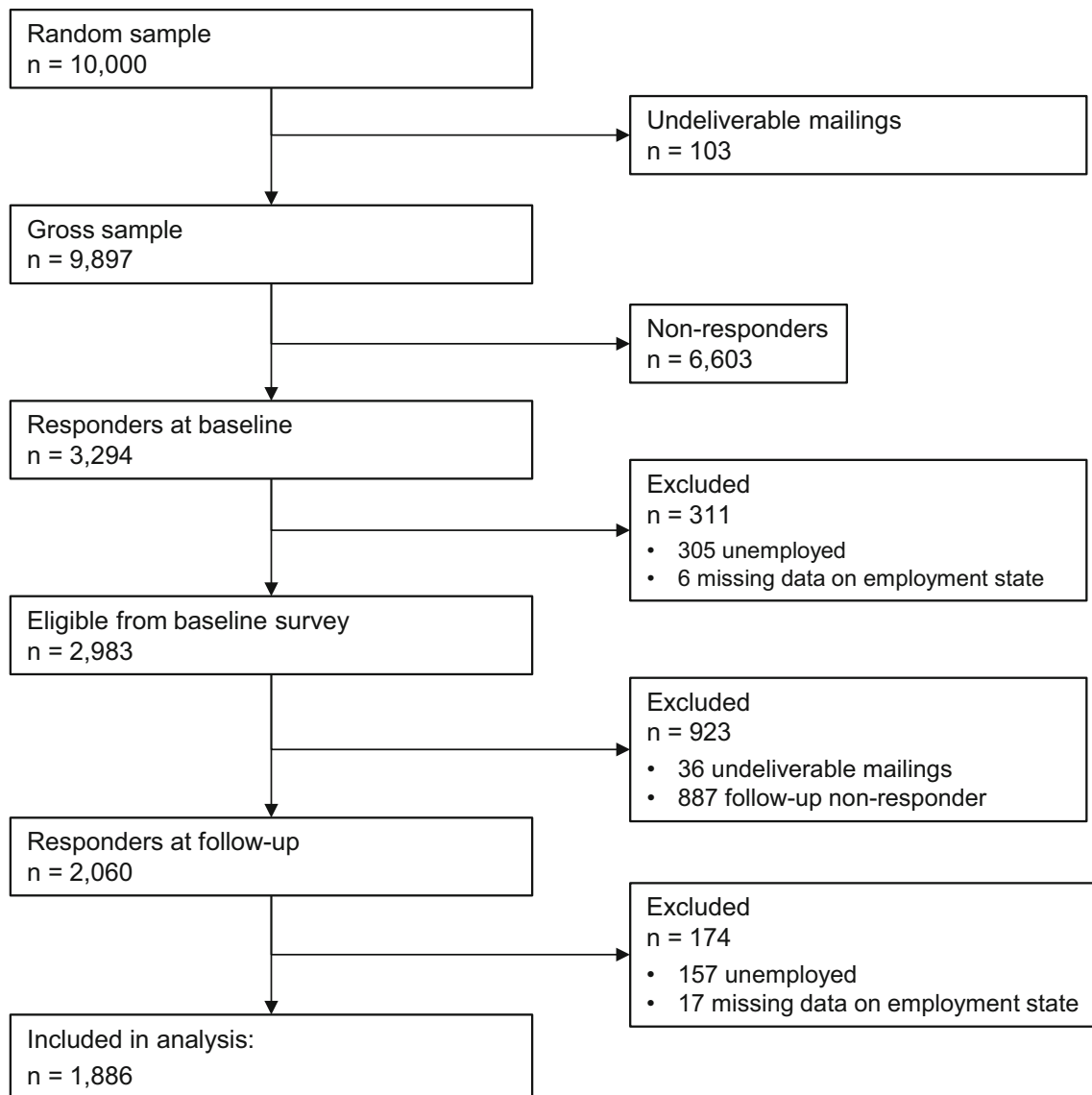


Fig. 1 Flow of participants in the Third German Sociomedical Panel of Employees (Germany, 2013–2015)

comparison to participants with low OIJ (model 1.1; Table 2). Without adjusting for OIJ, persons with high ER ratio had 1.93 times higher odds of poor work ability in comparison to participants with low ER ratio (model 1.2). Participants with moderate OIJ still had 1.33 times higher odds. Participants with moderate ER ratio still had 1.42 times higher odds. In model 1.3, high OIJ and high ER ratio showed independent adverse effects on work ability. Furthermore, participants with low educational level and persons with high neuroticism had a higher risk of poor work ability after 2 years.

Women had higher odds of poor work ability when OIJ was high. In men we found higher odds of poor work ability when ER ratio was high (Table 2). OIJ and ER ratio were moderated by sex in the final model. Men with high

OIJ had 0.52 times lower odds (95% CI 0.27, 0.99) for poor work ability compared to women with the same condition of OIJ. On the other hand, men had 2.15 times higher odds (95% CI 1.12, 4.10) of poor work ability when ER ratio was high.

Effects of organizational justice and effort–reward imbalance on emotional role functioning

Without adjusting for ER ratio, high OIJ had a remarkable effect on impaired emotional role functioning compared with low OIJ (model 2.1; Table 3). Odds were still increased for persons who reported moderate OIJ. Without adjusting for OIJ, persons with high ER ratio had 1.55 times higher odds of poor emotional role functioning

Table 1 Descriptive statistics of sample characteristics in the Third German Sociomedical Panel of Employees (Germany, 2013–2015)

Variable	<i>n</i>	% or mean (SD)	Cronbach's α
Baseline			
Age (40–54), mean (SD)	1886	48.0 (4.0)	
Age, % \geq 50	1886	40.2	
Sex, % male	1886	43.5	
Educational level, % moderate/low	1880	77.1	
Without partner, %	1850	20.5	
Neuroticism (3–21), mean (SD)	1871	12.3 (4.1)	0.71
Organizational injustice (1–5), mean (SD)	1814	3.1 (0.9)	0.94
ER ratio, mean (SD)	18,293	1.4 (0.6)	
ER ratio, % > 1		71.5	
ER ratio, % > 1.4		39.9	
Effort (3–12), mean (SD)	1871	9.2 (2.2)	0.77
Reward (7–28), mean (SD)	1837	17.2 (4.1)	0.82
Work ability (7–49), mean (SD)	1807	34.2 (7.6)	0.80
% very good		10.1	
% good		32.6	
% moderate		38.2	
% poor		19.1	
Emotional role functioning, mean (SD)	1875	72.0.6 (39.1)	0.85
Physical role functioning, mean (SD)	1886	67.6 (39.3)	0.86
Follow-up			
Work ability (7–49), mean (SD)	1824	34.7 (8.2)	0.70
% very good		13.4	
% good		33.7	
% moderate		34.4	
% poor		18.4	
Emotional role functioning, mean (SD)	1787	73.6 (37.4)	0.81
Physical role functioning, mean (SD)	1886	63.1 (40.5)	0.83

SD standard deviation, *ER ratio* effort–reward ratio

(model 2.2). This effect disappeared in the third model, where both components of justice were taken into account. In this model, however, participants with high OIJ had 1.83 times higher odds for poor emotional role functioning (model 2.3). Men and persons with high neuroticism showed higher risks of impaired emotional role functioning after 2 years.

Women with high levels of OIJ had higher odds of poor emotional functioning in the final model (Table 3). Men with high OIJ had lower odds of poor emotional functioning compared to women (OR 0.44, 95% CI 0.21, 0.90).

Effects of organizational justice and effort–reward imbalance on physical role functioning

Without adjusting for ER, ratio participants with high OIJ had 1.60 times higher odds of poor physical role functioning compared with participants with low OIJ (model 3.1; Table 4). Without controlling for OIJ, moderate and

high ER ratio increased the odds of impaired physical role functioning by 1.48 times in comparison to low ER ratio (model 3.2). There were no independent effects on physical role functioning when both justice components were taken into account.

Effects of OIJ and ER ratio on poor physical role functioning only were found in women (model 3.1 and model 3.2). In the final model, women with high OIJ had higher odds of poor physical role functioning. Effects of OIJ and ER ratio were not moderated by sex.

Interactions and combination of risks

Our tests of additivity neither indicated synergy nor antagonism in any outcome (work ability: RERI = -0.74 , CI 95% $-1.99, 0.51$; emotional role functioning: RERI = -0.86 , CI 95% $-1.94, 0.22$; physical role functioning: RERI = -0.04 , CI 95% $-0.85, 0.77$). Stratified analysis yielded similar results.

Table 2 Results of logistic regression analysis: effects of organizational justice and effort–reward imbalance on work ability in the Third Sociomedical Panel of Employees (Germany, 2013–2015)

	Model 1.1		Model 1.2		Model 1.3	
	OR	95% CI	OR	95% CI	OR	95% CI
All (<i>n</i> = 1886)						
ERI (moderate vs. low)			1.42	1.08, 1.85	1.29	0.98, 1.71
ERI (high vs. low)			1.93	1.46, 2.54	1.60	1.16, 2.19
OIJ (moderate vs. low)	1.33	1.02, 1.73			1.21	0.92, 1.59
OIJ (high vs. low)	1.91	1.43, 2.55			1.53	1.10, 2.13
Men (<i>n</i> = 821)						
ERI (moderate vs. low)			1.73	1.09, 2.77	1.79	1.08, 2.96
ERI (high vs. low)			2.40	1.55, 3.71	2.43	1.49, 3.98
OIJ (moderate vs. low)	1.03	0.66, 1.62			0.83	0.52, 1.34
OIJ (high vs. low)	1.45	0.91, 2.31			0.95	0.56, 1.61
Women (<i>n</i> = 1065)						
ERI (moderate vs. low)			1.25	0.90, 1.75	1.07	0.76, 1.53
ERI (high vs. low)			1.66	1.14, 2.41	1.21	0.79, 1.86
OIJ (moderate vs. low)	1.52	1.07, 2.16			1.47	1.03, 2.10
OIJ (high vs. low)	2.23	1.53, 3.24			2.04	1.33, 3.11

n = 1886; estimates were combined from five imputed data sets. All models are adjusted for baseline health, sociodemographic data, and neuroticism

ERI effort–reward imbalance, OIJ organizational injustice, OR odds ratio, CI confidence interval

Table 3 Results of logistic regression analysis: effects of organizational justice and effort–reward imbalance on emotional role functioning in the Third Sociomedical Panel of Employees (Germany, 2013–2015)

	Model 2.1		Model 2.2		Model 2.3	
	OR	95% CI	OR	95% CI	OR	95% CI
All (<i>n</i> = 1886)						
ERI (moderate vs. low)					1.06	0.78, 1.44
ERI (high vs. low)					1.19	0.84, 1.66
OIJ (moderate vs. low)	1.53	1.14, 2.07	1.22	0.91, 1.65	1.48	1.08, 2.02
OIJ (high vs. low)	1.99	1.45, 2.74	1.55	1.15, 2.09	1.83	1.28, 2.62
Men (<i>n</i> = 821)						
ERI (moderate vs. low)			1.09	0.69, 1.73	1.06	0.65, 1.72
ERI (high vs. low)			1.34	0.85, 2.11	1.22	0.73, 2.05
OIJ (moderate vs. low)	0.96	0.62, 1.49			0.92	0.58, 1.45
OIJ (high vs. low)	1.32	0.83, 2.10			1.20	0.71, 2.03
Women (<i>n</i> = 1065)						
ERI (moderate vs. low)			1.35	0.91, 2.01	1.09	0.72, 1.66
ERI (high vs. low)			1.74	1.17, 2.59	1.18	0.75, 1.87
OIJ (moderate vs. low)	2.25	1.45, 3.47			2.17	1.39, 3.40
OIJ (high vs. low)	2.75	1.75, 4.31			2.53	1.53, 4.20

n = 1886; estimates were combined from five imputed data sets. All models are adjusted for baseline health, sociodemographic data, and neuroticism

ERI effort–reward imbalance, OIJ organizational injustice, OR odds ratio, CI confidence interval

Discussion

Participants who were affected by injustice in their work environment showed increased odds of limited participation. Organizational injustice and ERI are important risk factors of impaired work ability and emotional and

physical role functioning, independent of other determinants. When organizational injustice and ERI were mutually adjusted, only work ability was affected by both independently. Significant effects of OIJ on all three outcomes were only found in women. Men with high ER ratio showed higher odds ratio of poor work ability. Men with

Table 4 Results of logistic regression analysis: effects of organizational justice and effort–reward imbalance on physical role functioning in the Third Sociomedical Panel of Employees (Germany, 2013–2015)

	Model 3.1		Model 3.2		Model 3.3	
	OR	95% CI	OR	95% CI	OR	95% CI
All (<i>n</i> = 1886)						
ERI (moderate vs. low)			1.36	1.01, 1.83	1.24	0.91, 1.69
ERI (high vs. low)			1.48	1.10, 1.99	1.26	0.90, 1.76
OIJ (moderate vs. low)	1.39	1.03, 1.88			1.31	0.95, 1.79
OIJ (high vs. low)	1.60	1.17, 2.19			1.43	1.00, 2.05
Men (<i>n</i> = 821)						
ERI (moderate vs. low)			1.47	0.91, 2.40	1.46	0.88, 2.42
ERI (high vs. low)			1.39	0.86, 2.26	1.37	0.80, 2.37
OIJ (moderate vs. low)	1.14	0.72, 1.81			1.03	0.64, 1.68
OIJ (high vs. low)	1.19	0.73, 1.95			1.03	0.59, 1.80
Women (<i>n</i> = 1065)						
ERI (moderate vs. low)			1.29	0.88, 1.88	1.13	0.77, 1.67
ERI (high vs. low)			1.52	1.05, 2.22	1.19	0.77, 1.82
OIJ (moderate vs. low)	1.57	1.05, 2.34			1.51	1.00, 2.29
OIJ (high vs. low)	1.92	1.25, 2.95			1.77	1.09, 2.86

n = 1886; estimates were combined from five imputed data sets. All models are adjusted for baseline health, sociodemographic data, and neuroticism

ERI effort–reward imbalance, OIJ organizational injustice, OR odds ratio, CI confidence interval

high OIJ showed lower odds ratio of poor work ability and emotional role functioning. An additive effect of both risk factors could not be shown.

To our knowledge, the present study is the first to investigate effects of organizational justice and ERI on work ability together in a longitudinal model. The results are in line with those of a cross-sectional study that worked out independent associations of organizational injustice and ERI (Spanier et al. 2014). With regard to the ER ratio, the present study supports the results of other longitudinal studies (Bethge and Radoschewski 2012; Bethge et al. 2012; Martinez et al. 2015).

While the WAI covers impairments to participation in terms of job demands, taking into account both mental and physical health, the role functioning scales refer to emotional and physical functioning separately. Though OIJ and ERI affected both role functioning scales when not mutually adjusted, the effects were small. If mutually adjusted, the effects on physical role functioning were not significant. The results suggest that aspects of unjust work are more likely to affect the emotional role of a person. These suggestions are in line with numerous studies that investigated associations between unjust work and mental health or clinical depression. However, there are only a few studies that have focused on associations between or effects of OIJ or ERI on physical impairments. In a study by Herr et al., independent effects of organizational justice and ERI were found for musculoskeletal pain in both blue-collar and white-collar workers (Herr et al. 2015).

The associations of injustice and the outcome variables differed between men and women. In women, OIJ affected the work ability and emotional role functioning, while ERI affected the work ability in men. At this time, there are no consistent findings concerning sex differences in the association of OIJ or ERI and several outcomes. Only a few studies included both OIJ and ERI in their studies. One of them the Whitehall II study reported no differences between women and men within their results of relational justice, ERI, and psychiatric morbidity (Ferrie et al. 2006). Head et al. found that of ERI was a stronger predictor of long spells of sickness absence in men and relational justice was a stronger predictor in women. However, they also found that there was in fact no significant interaction of sex and ERI or relational justice (Head et al. 2007).

A Finnish study examined the effects of combined risks of organizational injustice and ERI on general health perception and depression in two independent cohorts. In contrast to our findings, Kivimäki and colleagues proved additive effects on both outcomes in both cohorts (Kivimäki et al. 2007). In our study, however, the relationship between ERI and OIJ indicates an antagonism, but in fact no significant additive effect of ERI and OIJ was found.

In addition to the effects of the two main predictors, remarkable effects of neuroticism on all dependent variables were found. High levels of neuroticism have also been associated with health and employment in a number of other studies (Elovainio et al. 2003; Vlasveld et al. 2013). As neuroticism was also identified as an important

correlate for the negative assessment of organizational justice (Shi et al. 2009), neuroticism is an important confounder when studying the effects of OIJ on health and work participation outcomes.

A critical appraisal of our findings has to consider the following limitations. First, the persons in our sample were predominantly employed in the public sector. This was the result of sampling participants from the register of the Federal German Pension Insurance. Workers who are part of this pension scheme are characterized by higher levels of education, higher vocational qualifications and higher incomes and only few are exposed to high physical demands at the workplace compared to the general population. In addition to these factors the narrow age range and the previous health problem of the sample reduce the generalizability of our results. Descriptive statistics are therefore clearly not representative for employees in general. However, our concern was to study the relevance of work stress in a particular vulnerable group, i.e., aging workers with health problems. This is also an alternative explanation for the high prevalence of workers reporting an ER ratio > 1. This is a group gaining particular interest not only in Germany (Ishtiak-Ahmed et al. 2014; Kivimäki et al. 2007; Lund et al. 2008; Wallman et al. 2009). Second, the baseline response rate of only approximately one third increased the risk of selection bias. Though a comparison of respondents and non-respondents showed only minor differences related to age and sex, there might be further differences between these groups that are not accounted for. We see this primarily as a thread of generalizability, i.e., external validity of our findings. Third, selection bias may have been introduced due to the fact that further dropout after the first wave was once again linked to the sex and age of the participants. Additional analyses also indicated slight differences between responders and non-responders of the second wave. Persons who dropped out at follow-up had a slight average lower ER ratio than persons who participated in the follow-up survey. There were no further differences between these groups concerning OIJ and the outcome variables. Selection bias may occur when exposed persons with or without an event have different attrition rates. Though this could not be clarified, attrition of the exposed and the unexposed groups did only slightly differ.

The limitations are balanced by the following strengths. First, the study had a longitudinal design. Second, we adjusted for baseline values of the dependent variables and several confounders to estimate independent effects of the predictor variables. Third, the sample was randomly selected from the register of the country's largest pension body, the Federal Pension Insurance. Fourth, this sample was restricted to persons who had previously received sickness absence benefits—a group that is particularly at

risk of early retirement and permanent work disability and may be especially in need of just and transparent work conditions.

People who have already experienced impairments of health and work ability are in need of reliable structures and processes at work. Indeed, Bourbonnais and colleagues showed that organizational changes to strengthen fair work conditions for hospital workers decreased stress levels and increased mental health even at the three-year follow-up (Bourbonnais et al. 2011). Although the relevance of individual health behavior is beyond doubt, this indicates that prevention measures to maintain work ability must not be restricted to individual behavioral prevention, but should also support fair and equitable working conditions.

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Compliance with ethical standards

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Conflict of interest The authors declare that they have no competing interests.

Ethical approval The study protocol was approved by the ethics committee of the Hannover Medical School (ethics vote no. 1730-2013) and the data protection commissioner of the Federal German Pension Insurance.

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