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Job strain, effort-reward imbalance and employee well-being: a large-scale cross-sectional study

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Abstract

This study investigated the effects of the Job Demand-Control (JD-C) Model and the Effort-Reward Imbalance (ERI) Model on employee well-being. A cross-sectional survey was conducted comprising a large representative sample of 11,636 employed Dutch men and women. Logistic regression analyses were used.

Controlling for job sector, demographic characteristics (including educational level) and managerial position, employees reporting high job demands (i.e. psychological and physical demands) and low job control had elevated risks of emotional exhaustion, psychosomatic and physical health complaints and job dissatisfaction (odds ratios ranged from 2.89 to 10.94). Odds ratios were generally higher in employees reporting both high (psychological and physical) efforts and low rewards (i.e. poor salary, job insecurity and low work support): they ranged from 3.23 to 15.43. Furthermore, overcommitted people had higher risks of poor well-being due to a high effort — low reward mismatch (ORs: 3.57–20.81) than their less committed counterparts (ORs: 3.01–12.71). Finally, high efforts and low occupational rewards were stronger predictors of poor well-being than low job control when both job stress models were simultaneously adjusted.

In conclusion, our findings show independent cumulative effects of both the JD-C Model and the ERI Model on employee well-being and are not significantly different in men and women as well as in young and old people. In particular, high (psychological and physical) efforts and low rewards adversely affected employee well-being. Preliminary findings also indicate excess risks of poor well-being in overcommitted persons suffering from high cost — low gain conditions at work.

Keywords: Job strain; Effort-reward imbalance; Overcommitment; Employee well-being; The Netherlands

Introduction

The relationship between job characteristics and employee well-being has attracted considerable attention in the job stress literature. A number of conceptual models have been developed that relate job characteristics to the health and well-being of working populations (cf. Cooper, 1998; Parker and Wall, 1998). Among these, two theoretical frameworks have been particularly successful in generating and guiding job stress research: the Job Demand-Control Model (Kara-

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sek, 1979, 1998; Karasek and Theorell, 1990) and the Model of Effort-Reward Imbalance at work (Siegrist et al., 1986; Siegrist, 1996; 1998).

Job Demand-Control Model

The Job Demand-Control (JD-C) Model is a situation-centred model on which much of the current job stress research is based. In its basic form, the JD-C Model postulates that the primary sources of job stress lie within two basic characteristics of the job itself: (1) "psychological job demands" and (2) "job decision latitude" or "job control". Psychological job demands, or workload, are defined by Karasek (1979) as psychological stressors present in the work environment (e.g. high pressure of time, high working pace, difficult and mentally exacting work). The term "job decision latitude" has been described as the worker's ability to control his own activities and skill usage (Karasek and Theorell, 1990). Psychological strains are a consequence of the joint effects of the demands of a job and the range of job control available to the employee. These joint effects are also called interaction effects. The first major prediction of the JD-C Model is that the strongest adverse strain reactions (e.g. poor subjective health) will occur when job demands are high and worker's control is low (i.e. so-called high strain jobs). The second prediction of the model is that work motivation, learning and growth will occur in situations where both job demands and worker's control are high (i.e. so-called active jobs). Recent reviews of the model contend that the JD-C Model is appropriate for further investigation since the model has been shown to predict health and both motivational and productivity outcomes (e.g. see Schnall et al., 1994; Kristensen, 1995, 1996; Bosma et al., 1997; de Jonge and Kompier, 1997; van der Doef and Maes, 1998; Hemingway and Marmot, 1998).

Effort-Reward Imbalance Model

An alternative theoretical model, the Effort-Reward Imbalance (ERI) Model (Siegrist, 1996; 1998) puts its emphasis on the reward rather than the control structure of work (Marmot et al., 1999). Additionally, the model also includes personal characteristics (i.e. a specific coping pattern).

The focus of the ERI Model is put on the centrality of paid employment in adult life. The model posits that effort at work is spent as part of a socially organized exchange process to which society at large contributes in terms of occupational rewards. Rewards are distributed to employees by three transmitter systems: money (i.e. adequate salary), esteem (e.g. respect and support) and security/career opportunities (e.g. promotion prospects, job security and status consistency). The ERI Model claims that lack of reciprocity between 'costs' and 'gains' (i.e. high effort/low reward conditions) may cause a state of emotional distress which can lead to cardiovascular risks and other strain reactions (like poor subjective health and sickness absence). Having a demanding, but unstable job, achieving at a high level without being offered any promotion aspects, are examples of stressful imbalance.

Importantly, the ERI Model makes an explicit distinction between extrinsic (situational) and intrinsic (personal) components of effort-reward imbalance. It assumes that a combination of both sources provides a more accurate estimate of experienced stress than a restriction to one of these sources. Extrinsic or situational components consist of efforts (like psychological and physical demands at work) and the three dimensions of occupational rewards mentioned above. No a priori specification is made concerning adverse health effects of different types of both demands and rewards. Rather, it is the mismatch between high cost spent and low gain received which matters most. With regard to intrinsic or personal components, a specific pattern of coping with job demands and of eliciting rewards, termed 'overcommitment' is introduced. This pattern of coping defines a set of attitudes, behaviors and emotions reflecting excessive striving in combination with a strong desire of being approved and esteemed. People characterised by overcommitment tend to exaggerate their efforts. There is evidence that excessive efforts result from perceptual distortion (e.g. underestimation of challenge) which in turn may be triggered by an underlying motivation of experiencing esteem and approval (Siegrist, 1996).

The number of published empirical studies with the ERI Model are growing rapidly and the combination of high effort and low reward at work was found to be a risk factor for cardiovascular health, subjective health, mild psychiatric disorders and reported symptoms (e.g. Siegrist et al., 1990; Peter and Siegrist, 1997; Bosma et al., 1998; Peter et al., 1998a, 1998b; Stansfeld et al., 1998a; 1998b).

Aims of the study

It is important to note that the two job stress models differ in at least two important ways. Firstly, while the JD-C Model puts its explicit focus on task characteristics of the work place, the ERI Model covers a broader range of stressful experience at work as it includes more distant macroeconomic labor market aspects, such as job security, mobility and salaries. In terms of current developments of the labor market in a global economy, the emphasis on occupational rewards including job security reflects the growing importance

of fragmented job careers, of job instability, underemployment, redundancy and forced occupational mobility including their financial consequences. Therefore, it is of special interest to know whether both models explain employee well-being in a comparable way, or whether the model that addresses more fully these more recent trends produces relatively stronger effects.

Secondly, while the JD-C Model puts its attention only on situational characteristics, an explicit distinction is made between situational and personal characteristics in the ERI Model. In addition to the first research question a second question is analyzed that is related to the role of personal characteristics in studying associations of stressful job conditions and health. In particular, the ERI Model provides information on one such important personal characteristic, the coping pattern 'overcommitment'. Thus, the second research question explores whether a moderating effect of the intrinsic component of the ERI Model (i.e. overcommitment) is observed on associations between effort-reward imbalance (extrinsic component) and employee well-being. This second research question is restricted to analyses related to the ERI Model.

Both research questions add to the current state of the art. As Kasl mentioned in a recent contribution (Kasl, 1998), it is worth studying the relative contribution of each model to the explanation of well-being and health, in view of their differences and complementary aspects. So far, one first attempt has been made to compare the two models, showing that both effort-reward imbalance and job demand-control (low job control only) were independently related to the risk of developing coronary heart disease (Bosma et al., 1998). However, this study did not explore subjective well-being, nor was there information available on the relative contribution of psychological versus physical demands at work, a distinction that is clearly important as a substantial segment of the current workforce is still exposed to physical demands (e.g. Houtman, 1997; Paoli, 1997). In the current investigation we put special emphasis on this difference. With regard to the second research question it should be mentioned that statistical modelling so far, to a large extent, explored main effects of two summary measures of effort-reward imbalance (e.g. Peter et al., 1998a, 1998b) or of an aggregate measure combining the two components (e.g. Bosma et al., 1998; Siegrist, 1996). Yet, from a theoretical point of view it is of interest to specify the role of personal characteristics in an interactional perspective. Therefore, we provide preliminary information on the hypothesis that in overcommitted as compared to non-overcommitted employees, effects of effort-reward imbalance on employee well-being are substantially stronger. Finally, we analyse interaction effects of gender and age on the associations under study as these variables have shown to confound the relationship between job characteristics and employee well-being (cf. Karasek and Theorell, 1990; Spector, 1997; Schaufeli and Enzmann, 1998).

The present study addresses the research questions in a large sample of male and female employees representative of the Dutch workforce, with regard to four different measures of employee well-being; that is, emotional exhaustion, psychosomatic health complaints, physical health symptoms and job satisfaction.

Method

Procedure and participants

Participants were part of a large risk assessment project in the Netherlands, commissioned on behalf of the Dutch Labour Legislation (e.g. Mulder et al., 1997; de Jonge et al., 1999). The data were collected by means of a large-scale survey as part of an ongoing investigation in Dutch companies. The data collection procedure involved the distribution of self-report questionnaires among at random chosen employees. In order to guarantee anonymity, the completed questionnaire could be returned in a pre-stamped envelope to a research assistant. Unfortunately, there is no information available about the number of distributed questionnaires, implying that no return rates could be presented. The current study sample consisted of 11,636 participants from eight different job sectors: health care, transport, industry, office work, cleaning work, retail trade, warehouse and else.

A breakdown of the demographic characteristics of the study sample showed that 70% of the respondents were male and 29% female (1% had a missing value). Age ranged from 16 to 68 years (mean = 35.9, S.D. = 9.6). The mean work experience was 8.1 years (S.D. = 7.5) and 87% of the respondents worked full-time (i.e. 100%). Finally, 31% of the respondents reported a managerial position. These results converge for the greater part with several demographic characteristics from other large-scale Dutch studies, which means that the current sample seems to be quite representative for the Dutch working population (e.g. CBS, 1998; Houtman, 1997).

Measures

As measures of job characteristics, personal characteristics and outcome variables were not completely identical with the original measures of both models, proxy measures have been used instead.

Job characteristics

We used psychological demands, physical demands, job control and occupational rewards as predictor variables (cf. Mulder et al., 1997; de Jonge et al., 1999). Note that psychological demands and physical demands both also function as an indicator of extrinsic effort.

Psychological job demands (i.e. workload) are measured by an eight-item questionnaire that includes a wide range of qualitative and quantitative demanding aspects of the job (Cronbach's alpha is 0.87). An example item is: "In the unit where I work, work is carried out under pressure of time".

Physical demands are assessed by an seven-item questionnaire (Cronbach's alpha is 0.89). These items measure aspects like carrying heavy loads, constrained standing, to stoop deeply and to carry shoulder high. For instance, "In my work I have to carry shoulder high for a long time".

Job control is assessed by the Maastricht Autonomy Questionnaire (MAQ; de Jonge, 1995). The MAQ consists of ten items and measures the worker's opportunities to determine a variety of task elements, like the method of working, the pace of work and the work goals. Cronbach's alpha is 0.88. For example, "The opportunity that the work offers to determine the method of working yourself".

Occupational rewards are measured by four items reflecting its three core aspects: fair salary (1 item), social support (2 items, $r = 0.40$, $p < 0.001$) and job security (1 item).

Personal characteristics

As the original measure of overcommitment (Siegrist, 1996) was not applied in this study a somewhat crude proxy measure was included, the single item: "I am very much committed to my present job" (cf. Seashore et al., 1982).

Employee well-being indicators

In order to assess employee well-being, we analysed four different outcome variables: emotional exhaustion, psychosomatic health complaints, physical health symptoms and job satisfaction. For a conceptual justification of these indicators see Karasek (1998), Schaufeli and Enzmann (1998) and Warr (1998).

Emotional exhaustion is measured by four items of the Dutch version of the Maslach Burnout Inventory: the MBI-NL (Schaufeli and Van Dierendonck, 1994). According to Maslach (1998), emotional exhaustion is the most obvious manifestation of burnout. The questionnaire has a Cronbach's alpha of 0.84. An example item is: "I feel emotionally drained from my work".

Psychosomatic health complaints are measured by six items of specific psychosomatic health complaints (cf. Dirken, 1969). For instance, "Do you have trouble with chestpain in the last six months?". Cronbach's alpha is 0.72.

Physical health symptoms are measured by four items derived from a well-validated questionnaire (cf. Hildebrandt and Douwes, 1991). An example item is: "Do you have trouble with your low back in the last six months?". Cronbach's alpha is 0.74.

Job satisfaction is assessed by a single item; that is, "I am satisfied with my present job". It has been argued that a global index of overall job satisfaction (single item measure) is an inclusive and valid measure of general job satisfaction (e.g. Scarpello and Campbell, 1983; Wanous et al., 1997). Wanous et al. (1997) showed reasonable convergent validity of single-item measures with scales (average corrected correlations of 0.67).

Statistical analysis

Psychological demands, physical demands and job control were constructed by summing the scores on the individual items. In addition, the variables were split up in such a way that the most adverse tertile indicated high demands or low job control (cf. Bosma et al., 1998). The four reward indicators were dichotomised using the most adverse tertile to indicate low rewards. Furthermore, these dichotomous variables were counted to create a reward indicator. This indicator was also dichotomised (0,1 = no risk (i.e. 79.4%); 2,3,4 = at risk (i.e. 20.6%)). Both the job strain indicator and the effort-reward imbalance indicator were computed by creating four independent categories (cf. Karasek and Theorell, 1990): (1) low extrinsic efforts (job demands) and high rewards (or job control), (2) high efforts (demands) and high rewards (or job control), (3) low efforts (demands) and low rewards (or job control) and (4) both high efforts (demands) and low rewards (or job control). Except for job satisfaction, well-being indicators were constructed by summing the scores on the individual items. Furthermore, the variables were split using the highest tertile to indicate poor well-being. In case of job satisfaction, the lowest tertile indicated poor well-being.

Multivariate logistic regression analyses were then used to determine the associations between job strain or effort-reward imbalance and employee well-being. Multivariate odds ratios (ORs) and 95% confidence intervals (CIs) were derived from the logistic regression models. In all analyses, job sector, gender, age, education (low, medium, high), employment status (full-

time vs part-time) and managerial position (supervisor vs subordinate) were controlled for. Except for age, these variables were represented by dummy indicators in the logistic regression analyses. Finally, in a subsequent analysis, effort, reward and job control were simultaneously controlled for each other. It should be mentioned that it was not possible to put the four-category job stress models in one logistic model simultaneously, because the effort/demand part was the same in both job stress models, causing multicollinearity.

With respect to the possible moderating role of overcommitment, we dichotomised the corresponding variable accordingly. We used the bottom two tertiles indicating low overcommitment and the highest tertile to indicate high overcommitment. Next, we performed logistic regression analyses with overcommitment interacting with effort-reward imbalance. It should be noted that these interaction analyses have an exploratory function, as only a proxy measure for overcommitment (i.e. a single item) was available.

Results

First of all, a confirmatory factor analysis (LISREL 8) was conducted to show that indeed there are four separate outcome variables (cf. Jöreskog and Sörbom, 1993). The corresponding LISREL analysis showed that a four-factor solution yielded a significant chi-square ($\chi^2 = 4743.03$, d.f. = 84, $p < 0.001$), which means that the factor model statistically does not fit to the data. However, since the chi-square test is extremely affected by sample size, the test has a tendency to indicate a significant p-value above 200 cases, more or less independently of model fit (cf. Schumacker and Lomax, 1996). For this reason, we used several alternative fit indices (not or less affected by sample size) to check the factor model fit. These so-called practical fit indices (cf. Cuttance, 1987) showed that a four-factor solution was tenable since their values were reasonably good (NNFI = 0.92; CFI = 0.94; AGFI = 0.92; RMSR = 0.04). So, there are indeed four divergent outcome variables to reflect employee well-being (also Warr, 1998).

Table 1 describes the number and percentage of employees that reported high job strain (i.e. high demands and low control) and effort-reward imbalance (i.e. high efforts and low rewards). Missing observations were handled by listwise deletion. Table 1 shows on average that 10 to 15% of the people were categorised in the most adverse quadrants (i.e. high demands vs low control or high efforts vs low rewards).

The interaction terms between gender or age on the one hand and job strain or effort-reward imbalance on the other were not significant. All forthcoming analyses were therefore based on the total sample and gender and age were controlled for in the logistic regression models. Table 2 shows the results of the logistic regression analyses of the four well-being outcomes, by job strain and effort-reward imbalance, using *psychological* job demands as an effort/demand indicator.

Job strain was associated with elevated risks of emotional exhaustion, psychosomatic health complaints, physical health symptoms and job dissatisfaction. To be more specific, the risk of emotional exhaustion for workers who have both high demands and low control was about eleven times as high as that for workers with low demands and high control (OR = 10.94). Additionally, the risk of the other three outcomes for men and women who have high demands

Table 1
Number and percentage of employees reporting job strain and effort-reward imbalance ($N = 11{,}175$)

Type of demand/effort	Psychological demands		Physical demands	
	n	%	*n*	%
Job strain (JD-C Model)				
Low demands and high control	5123	45.8	5498	49.2
High demands and high control	2512	22.5	2137	19.1
Low demands and low control	2213	19.8	1814	16.2
High demands and low control	1327	11.9	1726	15.5
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	6127	54.8	6035	54.0
High efforts and high rewards	2745	24.5	2837	25.4
Low efforts and low rewards	1209	10.8	1277	11.4
High efforts and low rewards	1094	9.9	1026	9.2

Table 2
Odds Ratios (ORs)[a] and 95% Confidence Intervals (CIs) of poor well-being by job strain and effort-reward imbalance using psychological demands ($N = 11,175$)

Effort = psychological job demands	Emotional exhaustion	Psychosomatic complaints	Physical symptoms	Job dissatisfaction
Number (events)	11,175 (1335)	11,175 (1110)	11,175 (1248)	11175 (835)
Job strain (JD-C Model)				
Low demands and high control	1.00	1.00	1.00	1.00
High demands and high control	5.74 (4.85–6.79)	2.06 (1.74–2.44)	1.78 (1.51–2.11)	1.38 (1.13–1.69)
Low demands and low control	1.36 (1.09–1.70)	1.21 (1.01–1.45)	1.33 (1.13–1.57)	1.62 (1.33–1.99)
High demands and low control	10.94 (9.17–13.06)	3.13 (2.62–3.75)	2.89 (2.43–3.43)	3.31 (2.71–4.04)
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	6.63 (5.64–7.80)	2.06 (1.75–2.41)	2.03 (1.75–2.37)	1.59 (1.30–1.94)
Low efforts and low rewards	2.76 (2.20–3.45)	1.92 (1.57–2.35)	2.09 (1.74–2.50)	4.19 (3.43–5.12)
High efforts and low rewards	15.43 (12.88–18.49)	4.40 (3.67–5.28)	3.23 (2.70–3.88)	5.57 (4.54–6.82)
Effort, reward and control				
Efforts (psychological demands)	6.06 (5.30–6.93)	2.09 (1.83–2.39)	1.81 (1.59–2.06)	1.39 (1.19–1.63)
Occupational rewards	2.33 (2.04–2.65)	1.98 (1.72–2.27)	1.76 (1.54–2.02)	3.65 (3.13–4.25)
Job control	1.53 (1.34–1.75)	1.24 (1.08–1.43)	1.36 (1.19–1.55)	1.65 (1.41–1.93)

[a] Adjusted for job sector, gender, age, education, employment status and managerial position.

and low control was about three times as high as that for men and women with low demands and high control (ORs varied from 2.89 to 3.31). The same pattern of results, but with stronger effects, was found with regard to the four-categorical effort-reward imbalance indicator. This indicator was associated with elevated risks of emotional exhaustion, psychosomatic complaints, physical symptoms and job dissatisfaction. More specifically, the risk of emotional exhaustion for men and women who have both high efforts and low rewards was about fifteen times as high as that for workers with low efforts and high rewards (OR = 15.43). Furthermore, the risk of job dissatisfaction was about six times as high (OR = 5.57), whereas the risk of psychosomatic and physical health complaints were about four and three times as high, respectively (ORs were 4.40 and 3.23). Finally, when efforts, rewards and job control were simultaneously controlled, it appears that psychological demands (efforts) were the strongest predictors of emotional exhaustion, psychosomatic complaints and physical symptoms (bottom row of Table 2). Occupational rewards were the strongest predictors of job dissatisfaction.

Table 3 shows the results of the logistic regression analyses of the four well-being outcomes, by job strain and effort-reward imbalance, using *physical* job demands as an effort/demand indicator.

As can be seen from this table, the risk of poor well-being of employees suffering from high job strain was about three to five times as high as that for people with low demands and high control (ORs ranging from 3.08 to 5.00). The same is true for the effort-reward imbalance indicator, but the associations were again stronger (ORs varied from 4.37 for psychosomatic health complaints to 7.11 for job dissatisfaction). Finally, when efforts, rewards and job control were simultaneously controlled, Table 3 shows that occupational rewards were the strongest predictors of all outcomes except physical complaints. Physical demands (efforts) were the strongest predictors of physical health symptoms.

The previous analyses focused on the extrinsic components of the ERI Model. The final results to be presented here test the hypothesis of a moderating effect on well-being of the intrinsic component of the model; that is, the personal coping style overcommitment (Tables 4 and 5). It should be expressed again that these analyses have a preliminary and exploratory function, as we only used a proxy measure for overcommitment. Except for the association between physical demands and emotional exhaustion, people characterised by overcommitment in general had higher risks of poor well-being due to a high effort — low reward mismatch than their less committed counterparts. In particular, it appeared that in four out of eight situations there were statistically significant moderating effects of overcommitment. More specifically, Table 4 shows that for people characterised by overcommitment, the risk of emotional exhaustion for workers who have both high effort and low reward was about twenty-one times as high as that for

Table 3
Odds Ratios (ORs)[a] and 95% Confidence Intervals (CIs) of poor well-being by job strain and effort-reward imbalance using physical demands ($N = 11,175$)

Effort = physical demands	Emotional exhaustion	Psychosomatic complaints	Physical symptoms	Job dissatisfaction
Number (events)	11,175 (1335)	11,175 (1110)	11,175 (1248)	11,175 (835)
Job strain (JD-C Model)				
Low demands and high control	1.00	1.00	1.00	1.00
High demands and high control	2.22 (1.84–2.67)	2.36 (1.94–2.88)	3.20 (2.64–3.88)	2.00 (1.57–2.54)
Low demands and low control	2.07 (1.74–2.45)	1.50 (1.24–1.81)	1.27 (1.03–1.55)	2.01 (1.64–2.47)
High demands and low control	4.10 (3.39–4.95)	3.08 (2.51–3.77)	5.00 (4.12–6.07)	3.73 (2.95–4.72)
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	2.34 (1.97–2.79)	2.42 (2.01–2.91)	3.45 (2.89–4.11)	1.98 (1.57–2.50)
Low efforts and low rewards	3.48 (2.95–4.11)	2.60 (2.15–3.13)	1.86 (1.51–2.29)	4.23 (3.48–5.15)
High efforts and low rewards	5.61 (4.61–6.83)	4.37 (3.52–5.42)	6.46 (5.28–7.90)	7.11 (5.59–9.05)
Effort, reward and control				
Efforts (physical demands)	1.95 (1.68–2.27)	2.10 (1.79–2.47)	3.37 (2.88–3.94)	1.75 (1.45–2.12)
Occupational rewards	2.74 (2.42–3.10)	2.11 (1.83–2.42)	1.80 (1.57–2.06)	3.71 (3.19–4.32)
Job control	1.73 (1.52–1.97)	1.28 (1.11–1.47)	1.34 (1.17–1.53)	1.65 (1.41–1.93)

[a] Adjusted for job sector, gender, age, education, employment status and managerial position.

workers with low effort and high reward (OR = 20.81). For people *without* overcommitment, the risk of emotional exhaustion was smaller in case of high effort and low reward, but nevertheless nearly thirteen times as high as in case of low effort and high reward (OR = 12.71). The same was true for job dissatisfaction and for both psychological and physical demands (Tables 4 and 5). The risk of job dissatisfaction was about ten to eleven times as high for overcommitted employees, whereas the risk of job dissatisfaction was about four to five times as high for their less committed colleagues.

Discussion

The purpose of the present study was to test the

Table 4
Odds Ratios (ORs)[a] and 95% Confidence Intervals (CIs) of poor well-being by effort-reward imbalance and overcommitment using psychological demands ($N = 11,175$)

Effort = psychological job demands	Emotional exhaustion	Psychosomatic complaints	Physical symptoms	Job dissatisfaction
Interaction effect	$p < 0.10$	n.s.	n.s.	$p < 0.01$
Overcommitment is absent				
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	6.08 (4.93–7.50)	2.16 (1.74–2.67)	2.19 (1.80–2.68)	1.59 (1.26–2.00)
Low efforts and low rewards	2.38 (1.82–3.11)	1.85 (1.46–2.34)	2.03 (1.64–2.52)	3.27 (2.63–4.07)
High efforts and low rewards	12.71 (10.14–15.94)	4.05 (3.21–5.10)	3.01 (2.40–3.78)	4.48 (3.55–5.66)
Number (events)	*6256 (776)*	*6256 (678)*	*6256 (797)*	*6256 (676)*
Overcommitment is present				
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	7.84 (6.06–10.14)	1.98 (1.56–2.51)	1.89 (1.50–2.38)	2.46 (1.59–3.79)
Low efforts and low rewards	3.55 (2.30–5.47)	2.10 (1.42–3.09)	2.11 (1.47–3.02)	6.85 (4.04–11.60)
High efforts and low rewards	20.81 (15.47–28.01)	5.03 (3.76–6.72)	3.57 (2.65–4.82)	10.07 (6.44–15.74)
Number (events)	*4919 (559)*	*4919 (432)*	*4919 (451)*	*4919 (159)*

[a] Adjusted for job sector, gender, age, education, employment status and managerial position.

Table 5
Odds Ratios (ORs)[a] and 95% Confidence Intervals (CIs) of poor well-being by effort-reward imbalance and overcommitment using physical demands ($N = 11{,}175$)

Effort = physical demands	Emotional exhaustion	Psychosomatic complaints	Physical symptoms	Job dissatisfaction
Interaction effect	$p < 0.05$	n.s.	n.s.	$p < 0.05$
Overcommitment is absent				
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	2.66 (2.13–3.32)	2.30 (1.83–2.88)	3.65 (2.93–4.53)	1.72 (1.33–2.21)
Low efforts and low rewards	3.15 (2.51–3.96)	2.23 (1.74–2.86)	1.81 (1.39–2.37)	3.34 (2.66–4.18)
High efforts and low rewards	5.86 (4.62–7.45)	4.22 (3.27–5.44)	6.48 (5.07–8.24)	5.20 (3.99–6.77)
Number (events)	*6256 (776)*	*6256 (678)*	*6256 (797)*	*6256 (676)*
Overcommitment is present				
Effort-reward imbalance (ERI Model)				
Low efforts and high rewards	1.00	1.00	1.00	1.00
High efforts and high rewards	1.95 (1.52–2.50)	2.57 (1.98–3.34)	3.13 (2.44–4.02)	2.30 (1.43–3.69)
Low efforts and low rewards	4.19 (3.28–5.36)	3.32 (2.48–4.45)	1.97 (1.40–2.76)	5.60 (3.72–8.45)
High efforts and low rewards	5.44 (3.97–7.46)	4.56 (3.18–6.55)	6.50 (4.68–9.04)	11.38 (7.04–18.40)
Number (events)	*4919 (559)*	*4919 (432)*	*4919 (451)*	*4919 (159)*

[a] Adjusted for job sector, gender, age, education, employment status and managerial position.

effects of two prominent job stress models in a large representative sample of Dutch working men and women. Overall, the findings support both the Job Demand-Control Model and the Effort-Reward Imbalance Model. Both models had independent cumulative effects on poor well-being, using either psychological or physical demands. Moreover, both models showed similar effects on poor well-being in men and women as well as in young and old people. Controlling for job sector, demographic characteristics and managerial position, the findings demonstrate associations between job strain or effort-reward imbalance on the one hand and employee well-being on the other and all of them in the expected direction. The findings also indicate moderating effects of the person-specific component in the ERI Model (i.e. overcommitment).

Job strain

People reporting both high demands and low control had elevated risks of emotional exhaustion, psychosomatic health complaints, physical health symptoms and job dissatisfaction. These findings corroborate those in recent reviews on the JD-C Model (e.g. Schnall et al., 1994; Jones and Fletcher, 1996; Jones et al., 1998; van der Doef and Maes, 1998). Generally, the current findings provide renewed empirical support for the view that high strain jobs (high demand, low control) give rise to ill health or poor well-being outcomes (cf. Karasek and Theorell, 1990; Schnall et al., 1994; Theorell and Karasek, 1996; Karasek, 1998).

Effort-reward imbalance

Employees reporting a mismatch between their efforts and occupational rewards showed even more pronounced risks of emotional exhaustion, psychosomatic health complaints, physical health symptoms and job dissatisfaction, compared to people reporting job strain. The present results corroborate with earlier findings of these associations among male and female employees (e.g. Bosma et al., 1998; Peter et al., 1998a, 1998b). Additionally and also important, the current findings show that two further constellations of effort-reward associations call for attention, at least with respect to poor well-being: (1) low effort and low reward and (2) high effort and high reward. The corresponding odds ratios show differential associations between these two intermediate categories and the four well-being indicators. For instance, the risk of emotional exhaustion for the category employees of low efforts (psychological demands) as well as low rewards was about three times as high as that for employees with low efforts and high rewards (OR = 2.76). On the other hand, the risk of emotional exhaustion for men and women who have both high efforts and high rewards was about seven times as high as that for workers with low efforts and high rewards (OR = 6.63). Further research is needed to explore these differential effects in more detail.

The preliminary and exploratory findings of the presence or absence of overcommitment in relation to effort-reward imbalance are interesting. More specifically, in 50% of the cases there were statistically sig-

nificant moderating effects of overcommitment and all but one in the expected direction. These premilinary findings support our hypothesis that in overcommitted employees as compared to non-overcommitted people, effects of effort-reward imbalance are stronger. In other words, these employees were not capable to accurately assess cost-gain relations at work, probably due to a high need for control and approval (Siegrist, 1998).

Model comparison

Kasl (1998) has noted that comparisons of different types of job stress with respect to health or well-being outcomes are needed to advance the field. Our comparison of both models shows that the odds ratios concerning effort-reward imbalance were consistently higher than the odds ratios concerning job strain. Furthermore, in four out of eight cases, occupational rewards were the dominant predictors, when efforts, rewards and control were simultaneously controlled. Efforts were the strongest predictors of emotional exhaustion, psychosomatic health complaints (psychological demands) and physical health symptoms (both types of demands). Strikingly, job control had the lowest predictive power of all three job characteristics. This latter result is somewhat astonishing since the relationship between (low) job control and risks of coronary heart disease is well established (cf. Schnall et al., 1994; Theorell and Karasek, 1996; Bosma et al., 1997, 1998). The results concerning occupational rewards and effort-reward imbalance, however, are in line with recent changes in the nature of work. Flexibilization of work, together with the rise of new technology and global economy, has had an enormous impact on today's working life. It has led to the end of lifetime employment, to a growth in short-term contracts and, as a consequence, to increasing job insecurity (Siegrist, 1996, 1998; de Jonge and Kompier, 1997; Jones et al., 1998). From this particular point of view, occupational rewards seem to be more significant than job control. Detrimental effects may result from unfair or inadequate salaries, lack of support, lack of promotion prospects, or job loss. In stress theoretical terms, this study showed that unmet reward expectancies following high extrinsic efforts are most likely to provoke poor subjective well-being. As mentioned before, this phenomenon reflects the growing importance of career fragmentation, job instability, underemployment and forced downward mobility. Moreover, it also stresses the importance of the ERI Model to address more fully these trends in today's work, at least as far as subjective well-being is concerned.

Although the JD-C Model was never intended to incorporate all the job characteristics needed to explain the work-well-being relationship, a number of researchers have suggested that more dimensions are needed to adequately conceptualize psychosocial job characteristics (e.g. Karasek and Theorell, 1990; Schnall et al., 1994; Kristensen, 1995; Jones et al., 1998; Karasek et al., 1998; de Jonge et al., 1999). For instance, the inclusion of job insecurity and physical hazards have been suggested by several authors, including Karasek himself. The present findings express the importance of these job characteristics and support an expansion of the JD-C Model in this respect.

Methodological considerations

Several limitations of this study need to be taken into account. Firstly, although this large-scale sample is considered representative for the respective sectors of the Dutch workforce, the study is based on a cross-sectional design. Although JD-C and ERI theory guided our hypotheses about causal relationships, hypothesised causal relationships should, therefore, be interpreted carefully. In addition, generalization of the current findings to other countries awaits further empirical examination.

Secondly, original job strain and effort-reward measures were not available from this study. With respect to the JD-C Model, however, this is not a major problem, as the conceptualization and operationalization of Karasek's (1985) original psychological demands as well as job control have been much criticized (e.g. Jones and Fletcher, 1996; Kasl, 1996; Wall et al., 1996; de Jonge and Kompier, 1997; Theorell et al., 1998). In this respect, our demand and control measures may be better reflections of the intended JD-C constructs than the original ones (e.g. Jones et al., 1998; de Jonge et al., 1999). With regard to the ERI Model, replication of the present results using original measures of effort, reward and in particular overcommitment is highly recommended.

Thirdly, the present study relied on self-report measures of both independent and dependent variables. The problems associated with this practice are, for instance, a possible inflation of strength of relationships (e.g. Spector, 1992; Dormann, 1999). In the questionnaire, we tried to reduce the problem of conceptual and methodological overlap by (1) classifying job characteristics in terms quite different from those of the outcome variables, (2) measuring the indicators with differing response formats and (3) positioning measures of the indicators in different locations throughout a larger survey questionnaire. Unfortunately, we cannot test the strength of conceptual and methodological overlap, but several findings recently reported in the literature (e.g. Semmer et al., 1996; Spector and Jex, 1998) indicate that this phenomenon

is not very troublesome. Furthermore, a LISREL confirmatory factor analysis showed that there are four different and independent outcome variables to reflect employee (poor) well-being. This diverging validity also indicates that negative affectivity (i.e. the disposition to respond negatively to questionnaires) is unlikely to have biased our results very much.

A final point of attention is the arbitrary chosen cut-off points of the variables used. As there were neither natural nor clinically-based thresholds available, tertiles had been used instead. This might have led to a misclassification of subjects in some of the categories used.

In conclusion, the reported findings add to cumulating evidence of adverse effects on well-being produced by job strain and effort-reward imbalance. They also point to the promise of refining and combining information derived from either job stress model in future research.

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