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Linear and Nonlinear Relations Between Psychosocial Job Characteristics, Subjective Outcomes, and Sickness Absence: Baseline Results From SMASH

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This study investigates the demand–control–support (DCS) model by (a) using a more focused measure of job control, (b) testing for interactive and nonlinear relationships, and (c) further extending the model to the prediction of an objective outcome measure (i.e., company-administrated sickness absence). Hypotheses were tested in a heterogeneous sample of 1,739 employees from a 3-year prospective cohort study called SMASH (Study on Musculoskeletal Disorders, Absenteeism, Stress, and Health). Baseline results showed that a linear additive model was superior for job satisfaction, psychosomatic health complaints, and sickness absence, whereas a curvilinear model was superior for emotional exhaustion and depression. It is concluded that, first, there was no evidence of interactive effects. Second, it seems sensible to pay more attention to curvilinear relationships in future research. Finally, the DCS model was not supported using a more objective outcome measure.

One of the most popular models in the domain of job stress and employee health is the demand–control–support (DCS) model (Dollard & Winefield, 1998; Schnall, Landsbergis, & Baker, 1994). This model as proposed by Karasek and colleagues (Johnson & Hall, 1988; Karasek & Theorell, 1990) distinguishes itself from other job stress models by its simplicity and the extent to which it has gained a paradigmatic function in work and health research. Karasek and colleagues have inspired and encouraged much research not only in the field of occupational health psychology but also in the field of epidemiology and psychophysiology. Furthermore, the DCS model provides starting points for improvement of employee health by way of job redesign (see Dollard & Winefield, 1998). So, the DCS model is of both practical and theoretical importance, and therefore is an excellent example of a "middle ground" model (Karasek & Theorell, 1990).

The DCS model gives rise to two major predictions (see Karasek, 1979, 1998). The first major prediction is that the strongest aversive job-related strain reactions (such as depression, exhaustion, and health complaints) occur when jobs are simultaneously high in job demands, low in decision latitude, and low in workplace social support (i.e., high-strain jobs). The second prediction of the model is that work motivation, learning, and development opportunities occur particularly if job demands, decision latitude, and workplace social support are simultaneously at high levels (i.e., active jobs).

Over the years the amount of empirical tests of the DCS model has been overwhelming (Schnall, Landsbergis, & Baker, 1999). However, the core assumption that particularly the combination of job demands, decision latitude, and social support involves stronger responses (so-called interaction effects) has received little empirical support. More often job characteristics have main effects on the outcome variables (e.g., De Jonge & Kompier, 1997; Dollard & Winefield, 1998; Jones & Fletcher, 1996; Kristensen, 1995). Although there seems to be a growing consensus that job demands, decision latitude, and workplace social

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Using the Job-Related Affective Well-Being Scale (JAWS) to Investigate Affective Responses to Work Stressors

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Prior research linking job stressors to psychological strains has been limited to a small number of emotional reactions. This article describes research linking job stressors to a wide range of affective states at work. In Study 1, a multidimensional scaling procedure was used on a matrix of similarity judgments by 51 employees of 56 job-related affective statements to support a 2-dimensional view of affective well-being. In Study 2, ratings of the affect statements by 100 employees further supported the contention that the dimensions were pleasure–displeasure and degree of arousal. In Study 3, 114 full-time university employees responded to the Job-Related Affective Well-Being Scale, which was found to be related to measures of job stressors as well as job satisfaction and physical symptoms.

In recent years job stress researchers have begun to pay increasing attention to the role of emotions as indicators of strain and well-being at work (e.g., Daley & Parfitt, 1996; Daniels, Brough, Guppy, Peters-Bean, & Weatherstone, 1997; Sevastos, Smith, & Cordery, 1992; Wright & Doherty, 1998). Most job stress research has been limited to a small number of affective or affect-related strains, such as job dissatisfaction or work anxiety. It is clear that insufficient attention has been paid to other positive and negative emotional states (Pekrun & Frese, 1992). In this article we discuss three studies from a line of research to assess a variety of emotions in the workplace. This research first shows that a meaningful two-dimensional structure underlies emotional reactions at work and serves as the basis for the development of the Job-Related Affective Well-Being Scale, or JAWS. We then show how job stressors relate to four categories of affective reactions to work.

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Copies of the Job-Related Affective Well-Being Scale and updated information can be found online at http://chuma.cas.usf.edu/~spector.

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Structure of Emotions

Warr (1987) developed a model of affective well-being at work that was based on the experience of a variety of specific emotional states. His structure of affective well-being is derived from Russell's (1979, 1980) two-dimensional model of affect, which tends to view emotions not as discrete or independent but as highly and systematically interrelated. Russell used multidimensional scaling techniques to look at the cognitive structure underlying individuals' ratings of affective states. In the resulting circumplex model, emotion terms are represented on a continuous circle (see Figure 1). Terms closer to being synonyms (*happy* and *delighted*) are located closer together on the circle; antonyms (*happy* and *sad*) are opposite on the circle. The two bipolar dimensions of *pleasure* and *arousal* define the space of the circumplex. Pleasure–displeasure is represented on the horizontal dimension and relates to a traditional view of emotional valence. Arousal, a continuum ranging from sleep to high arousal, is the vertical axis and relates to a traditional view of emotion as activation. Thus, each affective state can be identified and differentiated from other affective states by where it lies in the two-dimensional space. The advantage of the circumplex is that it can represent not only a large number of emotions but also interrelationships among categories based on degrees of similarity and continuous variation.

This two-dimensional model of emotions has been empirically supported in many different settings (e.g.,

with Selye's (1956) stress paradigm as well as related, classic "performance" theories by both Yerkes and Dodson (1908) and Wundt (1922). Neither too much nor too little strain is good for the organism (see also Karasek, 1998). In 1987 Warr came up with his "vitamin model" that has breathed new life into possible nonlinear relationships between job characteristics and measures of job-related strain. The vitamin model is based on "an analogy with the fact that vitamins are required for physical health up to, but not beyond, a certain level; after attainment of that level increased vitamin intake can be harmful" (Warr, 1990, p. 286).

According to Warr (1990, 1994), both low and high job demands and both little and much decision latitude are unfavorable for employees' health. For instance, not only too little, but also too much decision authority may lead to strain (i.e., a U-shaped curve is postulated). Most notably, Warr's (1990) own study among nearly 1,700 employees supported the proposed nonlinear relationships. He found significant curvilinear relationships between job demands on the one hand and job satisfaction, job-related anxiety, and job-related depression on the other. As regards decision latitude, Warr found a curvilinear association with job satisfaction. More recently, De Jonge and Schaufeli (1998) did find significant curvilinear relationships among job demands, job autonomy, and social support on the one hand and job satisfaction, emotional exhaustion, and job-related anxiety on the other. Practically, curvilinear relationships would call for an optimum dose of job characteristics in the work situation. Increasing job autonomy in the workplace, for instance, should be tailor-made to prevent job-related strain.

In sum, there is a reason to investigate nonlinear relationships between job characteristics and job-related strain within the DCS model from both a theoretical and a practical point of view. In addition, several authors have suggested that the (non)existence of interactive relations might be caused by the existence of nonlinear effects for one of the job characteristics (e.g., Lubinski & Humphreys, 1990; Warr, 1990). So, in addition to interactive relations, we also look at nonlinear relationships in the present study.

Objective Outcome Measure

Finally, most previous studies in the DCS model relied exclusively on self-report questionnaires of both job characteristics and job-related strain variables. The main problem with this method is that it is more prone to bias than more objective measures (cf. Frese & Zapf, 1988; Kasl, 1996; Kristensen, 1996). Trivial correlations may occur because of either methodological overlap or conceptual overlap between independent and dependent measures. Therefore, use of more objective measures (i.e., gained from a source independent of the worker) has been recommended whenever possible to obtain adequate information about job characteristics or workers' health (cf. Dwyer & Ganster, 1991; Fox, Dwyer, & Ganster, 1993; Frese & Zapf, 1988). Therefore, in the present study we included an objective outcome measure: company-administrated sickness absence. There is basic agreement that perceived job-related strain may be implicated in behavioral outcomes such as absenteeism and sleep disturbances (cf. Beehr, 1998; Shirom, 1998). As a consequence, administrated sickness absence may be regarded as a long-term behavioral indicator of job-related strain (cf. Allegro & Veerman, 1998; Beehr, 1998).

As several authors have noted, no consistent relationships between job characteristics and objectively recorded sickness absence emerge from reported DCS studies (e.g., Dwyer & Ganster, 1991; Houtman et al., 1999; North et al., 1993; North, Syme, Feeney, Shipley, & Marmot, 1996; Peter & Siegrist, 1997; Vahtera, Pentti, & Uutela, 1996). This may be due to, for instance, differences in the way job characteristics and sickness absence were measured, as well as the population studied. In this context, demand–control–support interactions have hardly been found. Generally, it seems that high job control whether or not in combination with low job demands is associated with a lesser number of objectively recorded sickness absence spells.

In summary, this study attempted to overcome the criticism on the decision latitude concept by treating decision authority and skill discretion as separate theoretical and empirical constructs. By using a more focused measure of job control (i.e., decision authority), we expected to demonstrate the predicted interaction effects. Furthermore, we focused on the nature of the relationships between job characteristics and job-related strain. Last but not least, an extra benefit of this study was the use of both affective outcome variables and an objectively recorded measure of employee health. The added value of this study is in the simultaneous test of these three aspects in one study in combination with a large representative sample. In this respect, this study differentiates from other recent studies into the DCS model, which in general emphasize only one of these aspects.

The main question is whether job characteristics combine in a linear additive, a linear interactive, or a curvilinear way to predict job-related strain. Accordingly, two hypotheses were formulated:

Hypothesis 1. High job demands combined with low job control and low workplace social support are associated with the strongest aversive strain reactions (i.e., their combination results in an effect that is larger than the sum of the individual effects).

Hypothesis 2. Job demands, job control, and workplace social support are curvilinearly associated with strain. Inverted U-shaped patterns are expected among job demands, job control, and social support on the one hand and job satisfaction on the other. U-shaped patterns are expected among job demands, job control, and social support on the one hand and emotional exhaustion, depression, psychosomatic health complaints, and sickness absence on the other.

These hypotheses were set against a null hypothesis (H_0) that neither interactive nor curvilinear relationships exist.

Method

Sample and Procedure

This baseline study is part of a large 3-year prospective cohort study on work-related and non-work-related risk factors for musculoskeletal disorders, called the Study on Musculoskeletal Disorders, Absenteeism, Stress, and Health (SMASH). For a full description of the survey design, we refer to Bongers (1996). The majority of the measures of present interest were part of a comprehensive self-administered questionnaire. The data of this baseline study were collected between March 1994 and April 1995. The initial sample consisted of 2,064 employees from 34 Dutch companies from various sectors (i.e., industry and services). The response to the questionnaire was 87% (i.e., 1,786 respondents). To ensure valid and reliable observations of the work situation, we excluded workers who had less than 1 year experience in their current job, those who had a temporary contract, and those who received a benefit because of (partial) disability for work (cf. Frese & Zapf, 1994; Katz, 1978). Consequently, the final sample consisted of 1,739 "experienced" employees.

The sickness absence data were collected by means of a standard protocol. During a full calendar year (i.e., 1994), personnel managers of the different companies recorded frequency, length, and reason of sickness absence. The absenteeism data of five companies were not available. As a consequence, the statistical analyses regarding sickness absence were based on 1,412 employees.

Of the respondents, 70% were men and 30% were women. Ages ranged from 18 to 59 years (M = 35.50, SD = 8.75). The mean length of service was 9.55 years (SD = 7.72). Eleven percent of the employees did not complete primary education or completed only primary education, 41% of the employees completed lower vocational education, and 28% completed lower secondary education or middle vocational education. Both higher vocational education and academic education were reported by 10% of the workers each. The demographic variables of the full group (N = 1,739) were compared with those of the sickness absence group (n = 1,412). This comparison did not reveal any significant differences between the two groups.

Measures

The demographic variables age, education, and gender (dummy variable) were included as control variables. These variables have shown to confound the postulated relationship between job characteristics and employee health (e.g., Karasek & Theorell, 1990; Vahtera et al., 1996; Warr, 1990).

Job demands, decision authority, skill discretion, and workplace social support were measured by a Dutch translation of Karasek's Job Content Questionnaire (Karasek, 1985; Karasek et al., 1998) with response scales ranging from 1 = *strongly disagree* to 4 = *strongly agree*.

Job demands were measured by a five-item scale. To improve its theoretical and psychometrical quality, we replaced the item about conflicting demands by the statement "My job is very hectic" on the basis of principal-axis factor analyses. In our opinion, the former item refers to role ambiguity, whereas the other items refer to quantitative psychological workload. Factor analyses confirmed this idea. Coefficient alpha of this five-item scale was .65.

Skill discretion was measured by a five-item scale. The item on repetitive work was excluded to enhance its psychometric quality (cf. Kasl, 1996; Smith, Tisak, Hahn, & Schmieder, 1997). Factor analysis as well as reliability analysis confirmed the deletion of this item (see also Karasek et al., 1998). The remaining five questions related to utilization of workers' skills, their opportunity to learn new things at work, and variety of tasks. Coefficient alpha of this five-item scale was .74.

Decision authority was assessed by three items about the freedom to make decisions on the job that relate to work content as well as to ways of production (what is produced and how it is produced). Coefficient alpha was .65.

Workplace social support was assessed by an eight-item scale, which includes four questions about supervisor support and four questions about coworker support. Coefficient alpha was .81.

In line with the strain hypothesis of the DCS model, we used four subjective strain variables (i.e., job satisfaction, emotional exhaustion, depression, and psychosomatic health complaints) and two more objective variables (i.e., sickness absence duration and frequency).

Job satisfaction was assessed by a single item (i.e., "Do you mostly enjoy your work?") that was answered on a 4-point rating scale (1 = *hardly ever or never* to 4 = *most or all the time*). It has been shown that such a global rating of overall job satisfaction is an inclusive measure of general job satisfaction (e.g., Scarpello & Campbell, 1983; Wanous, Reichers & Hudy, 1997). Added to this, Wanous et al. (1997) showed reasonable convergent validity of single-item measures with multiple-item scales (average corrected correlations of .67).

Emotional exhaustion was measured by a subscale of the Dutch version of the Maslach Burnout Inventory (MBI-NL; Schaufeli & Van Dierendonck, 1993). The scale consisted of seven items, scored on a dichotomous (yes/no) scale. An illustrative statement is "I feel emotionally drained from my

work." In the MBI-NL, one original item (Item 16) has been eliminated because of its insufficient factorial validity (see Schaufeli & Van Dierendonck, 1993). In this study another original item (Item 6) was omitted because it applies only to people-oriented jobs. The scale was constructed by adding up the scores. Coefficient alpha was .72.

Depression was measured by a Dutch translation of a short version (Iowa form) of the Center for Epidemiologic Studies Depression (CES–D) scale (Kohout, Berkman, Evans, & Cornoni-Huntley, 1993; Radloff, 1977). The CES–D was designed to measure current level of depressive symptomatology, with emphasis on the affective component, that is, depressed mood. The participant was offered 11 brief statements describing feelings or behaviors and was asked to indicate how often she or he felt that way during the past 2 weeks. An illustrative statement is "I felt everything I did was an effort." Items were answered on a 3-point rating scale ranging from 1 = *hardly ever or never* to 3 = *much or most of the time*. Coefficient alpha was .74.

Psychosomatic health complaints were assessed by a well-validated Dutch questionnaire on how people view their health (Dirken, 1969; Joosten & Drop, 1987). Questions relate, for example, to complaints of pain in chest and region of the heart, dizziness, stomach problems, and fatigue. The questionnaire was composed of 13 items that were scored on a dichotomous (yes/no) scale. Similar to the exhaustion measure, this scale was constructed by adding up the scores. Coefficient alpha was .75.

Sickness absence has been conventionally measured in two ways, through the time-lost index and the frequency index (see Warr, 1996). The time-lost index was computed as the total duration of sickness absence (in days) during one full calendar year (i.e., 1994). The frequency index was computed as the number of separate spells of sickness absence during one full calendar year, regardless of their duration.

Data Analysis

The most widely used approach to test interactions between continuous variables is hierarchical regression analysis including multiplicative terms in the equations, thereby controlling for main effects (cf. Aiken & West, 1991; Cohen & Cohen, 1983). In a similar vein, to test for curvilinear associations, we included quadratic terms instead of multiplicative terms in the regression analysis (see Jaccard, Turrisi, & Wan, 1990).

An additive model (i.e., demographic variables and job characteristics) was compared with an interactive model and a curvilinear model, respectively, by means of an incremental F test (cf. Jaccard et al., 1990; Tabachnik & Fidell, 1989). Finally, we centered the job characteristics (i.e., mean distraction) to reduce problems of multicollinearity. As a result, unstandardized regression coefficients are presented in the tables (cf. Aiken & West, 1991; Jaccard et al., 1990).

Results

Preliminary Analyses

Examination of the raw data revealed a positively skewed distribution for duration of sickness absence (i.e., skewness = 3.95, kurtosis = 20.19). This means that there were a lot of low scores (i.e., 0), which is a common finding (see Allegro & Veerman, 1998). To normalize the skewed distribution, we square-root transformed the scores on sickness absence duration (see Tabachnik & Fidell, 1989). This transformation made the distribution approximately normal (i.e., skewness = 1.45, kurtosis = 2.60). Furthermore, before the regression analyses, the means, standard deviations, and zero-order Pearson correlations of the variables were calculated (see Table 1).

As shown in Table 1, the correlations between the job characteristics and the outcome measures were significant and in the expected direction, except for the nonsignificant correlation between job demands and sickness absence (both duration and frequency) and social support and sickness absence duration, respectively. The demographic variables were correlated with both the job characteristics and various outcome variables. As would be expected, the subjective outcome measures were intercorrelated (see Table 1). A confirmatory factor analysis was conducted to show that there are four separate subjective outcomes: job satisfaction, emotional exhaustion, depression, and psychosomatic complaints. The corresponding LISREL analysis (Jöreskog & Sörbom, 1993) showed that a four-factor solution yielded an acceptable chi-square relative to its degrees of freedom, $\chi^2(458, N = 1{,}538) = 1{,}994.93$, $p < .001$, and reasonable other fit indexes: nonnormed fit index = .86; comparative fit index = .87; Akaike's information criterion = 2,134.93; adjusted goodness-of-fit index = .91; and root-mean-square error of approximation = .05. So, there are indeed four divergent outcome variables to reflect employee (adverse) health.

Regression Analyses

Table 2 shows the results of the hierarchical regression analyses predicting all six outcome measures. In the regression analyses with both emotional exhaustion and depression as the outcome variable, a curvilinear model was superior. These results are in line with our second hypothesis. For the other outcome measures (i.e., job satisfaction, psychosomatic health complaints, and two measures of sickness absence), an additive model fitted the data best.

Prediction of job satisfaction. The results showed that decision authority, skill discretion, and social support were positively associated with job satisfaction, whereas job demands were negatively related to job satisfaction. Furthermore, it may be noted that both decision authority and skill discretion were

Table 1

Means, Standard Deviations, and Zero-Order Pearson Correlations for All Study Variables, Listwise Deletion of Missing Data (N = 1,571; Sickness Absence n = 1,283)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender[a]			—												
2. Age	35.50	8.75	.16*	—											
3. Education[b]	2.67	1.11	−.16*	−.06*	—										
4. Job demands	2.59	.45	−.02	.03	−.03	—									
5. Decision authority	2.73	.58	.14*	.06*	.20*	−.09*	—								
6. Skill discretion	2.91	.52	.18*	.14*	.20*	.06*	.60*	—							
7. Social support	2.86	.39	−.04	−.02	.00	−.12*	.25*	.25*	—						
8. Job satisfaction	2.36	.71	−.13*	.04	−.03	−.08*	.24*	.23*	.28*	—					
9. Emotional exhaustion	1.23	1.55	−.01	.03	−.04	.38*	−.14*	−.10*	−.23*	−.30*	—				
10. Depression	1.27	.27	−.10*	.00	.01	.13*	−.18*	−.11*	−.14*	−.19*	.33*	—			
11. Psychosomatic health complaints	2.69	2.57	−.15*	.06*	−.02	.11*	−.11*	−.06*	−.11*	−.14*	.45*	.41*	—		
12. Sickness absence duration	21.07	41.08	−.10*	.02	−.17*	.03	−.12*	−.07*	.00	.01	.06*	.16*	.21*	—	
13. Sickness absence frequency	1.60	1.70	−.13*	−.15*	.01*	.02	−.12*	−.09*	−.10*	−.10*	.14*	.20*	.26*	.38*	—

[a] Gender was coded 0 = female and 1 = male. [b] Education was coded 1 = little education or primary education, 2 = lower vocational education, 3 = secondary education or middle vocational education, 4 = higher vocational education, 5 = academic education.

* $p < .05$.

Table 2
Hierarchical Regression Analyses on Job Satisfaction, Emotional Exhaustion, Depression, Psychosomatic Health Complaints, and Sickness Absence (SA) by Demographic Variables and Job Characteristics

Variable	Job satisfaction	Emotional exhaustion	Depression	Psychosomatic complaints	SA duration[a]	SA frequency[b]
Model	Additive	Curvilinear	Curvilinear	Additive	Additive	Additive
R^2	.16	.20	.07	.06	.05	.05
Overall $F(df)$	45.53*** (7, 1653)	39.77*** (10, 1641)	11.14*** (10, 1577)	13.95*** (7, 1582)	10.80*** (7, 1345)	10.61*** (7, 1345)
F_{inc} (df)		8.24*** (3, 1641)	3.10* (3, 1577)			
R^2_{inc}		.01	.01			
	Unstandardized regression coefficient					
Gender	−.29***	.08	−.05**	−.98***	−.78***	−.40***
Age	.00	.00	.00	.02***	−.01	−.03***
Education	−.07***	−.02	.00	−.08	−.54***	.00
Job demands	−.11**	1.20***	.06***	.48***	.10	.04
Decision authority	.17***	−.10	−.07***	−.30*	−.58**	−.27**
Skill discretion	.21***	−.22*	.00	.16	.29	.06
Social support	.37***	−.56***	−.06***	−.64***	−.40	−.40**
Job demands^2		.28*	−.03			
Decision authority^2		−.04	.02			
Social support^2		.47***	.05*			

[a] Number of days absent in one calendar year. [b] Number of times absent in one calendar year.
* $p < .05$. ** $p < .01$. *** $p < .001$.

positively related to job satisfaction and that these associations were more or less equally strong.

Prediction of emotional exhaustion. The findings obtained from the regression analyses with emotional exhaustion as outcome variable were in favor of a curvilinear model. As can be seen in Table 2, a curvilinear model is superior to an additive model as the incremental F test is significant, $F_{inc}(3, 1641) = 8.24$, $p < .01$. To be more specific, we found a significant curvilinear relationship between (a) job demands and emotional exhaustion and (b) social support and emotional exhaustion. In Figures 1 and 2, the curvilinear effects are represented following the method recommended by Aiken and West (1991). The regression equation consisted of the squared term as well as the main term of a job characteristic. All other variables were assumed to have average levels and hence were not involved in the equations.

Figure 1 shows a J-shaped curve: An increase of job demands is associated with a nonproportional increase of emotional exhaustion. In other words, job demands hardly relate to emotional exhaustion at low levels of demands, but the higher the demands, the stronger the association. Figure 2 presents a U-shaped curve which indicates that low levels and to a lesser extent high levels of social support are associated with a higher level of emotional exhaustion. Regarding the main effects of the curvilinear model, it can be seen that skill discretion and social support were negatively related to emotional exhaustion, whereas job demands were positively associated with emotional exhaustion. These main effects may be interpreted in terms of the average effect of an independent variable across values of a higher order variable. The average effect of an independent variable on a dependent variable usually will be a meaningful piece of information (Jaccard et al., 1990). Furthermore, it may be noted that decision authority was also negatively related to emotional exhaustion. Compared with skill discretion, however, the association was weaker and statistically not significant.

Prediction of depression. The third column of Table 2 shows the results of the regression analyses predicting depression. As can be seen, a curvilinear model had a better model fit than an additive model, $F_{inc}(3, 1577) = 3.10$, $p < .05$. A closer inspection of the relationship between social support and depression revealed that low levels of support and to a lesser extent high levels of support were associated with higher levels of depression (see Figure 3).

As far as the main effects of the curvilinear model are concerned, the results showed that decision authority and social support were slightly negatively associated with depression, whereas job demands were slightly positively related to depression. Further-

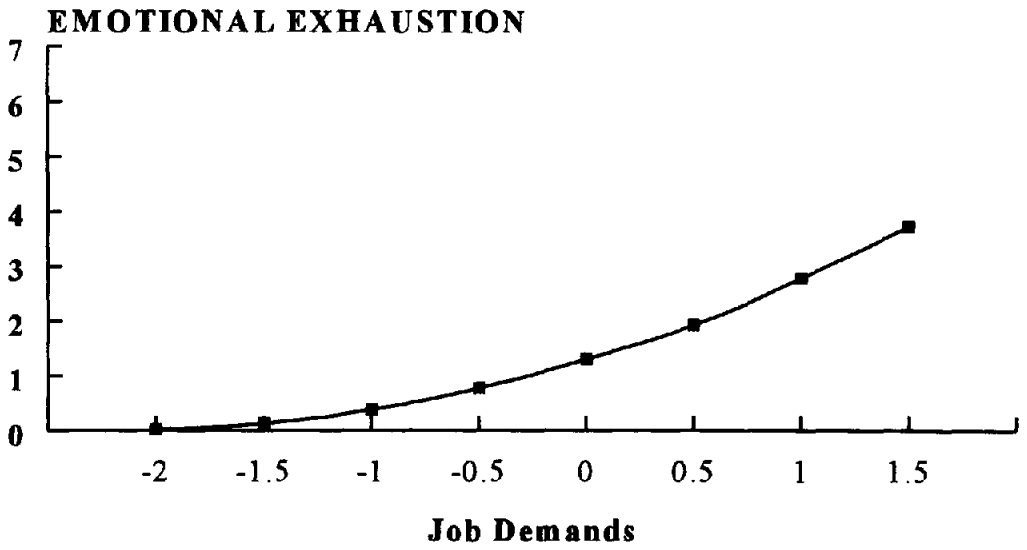

Figure 1. Graphical representation of the curvilinear relationship between job demands and emotional exhaustion (N = 1,651).

more, it may be noted that skill discretion was not related to depression at all.

Prediction of psychosomatic health complaints and sickness absence. The results of the regression analyses predicting psychosomatic health complaints, sickness absence duration, and sickness absence frequency are shown in columns 4 to 6 of Table 2. The results revealed only significant main effects. Consequently, the results were in favor of additive models for these outcome variables. It appeared that job demands were positively related to psychosomatic health complaints. Furthermore, social support was negatively associated with both psychosomatic health complaints and sickness absence frequency.

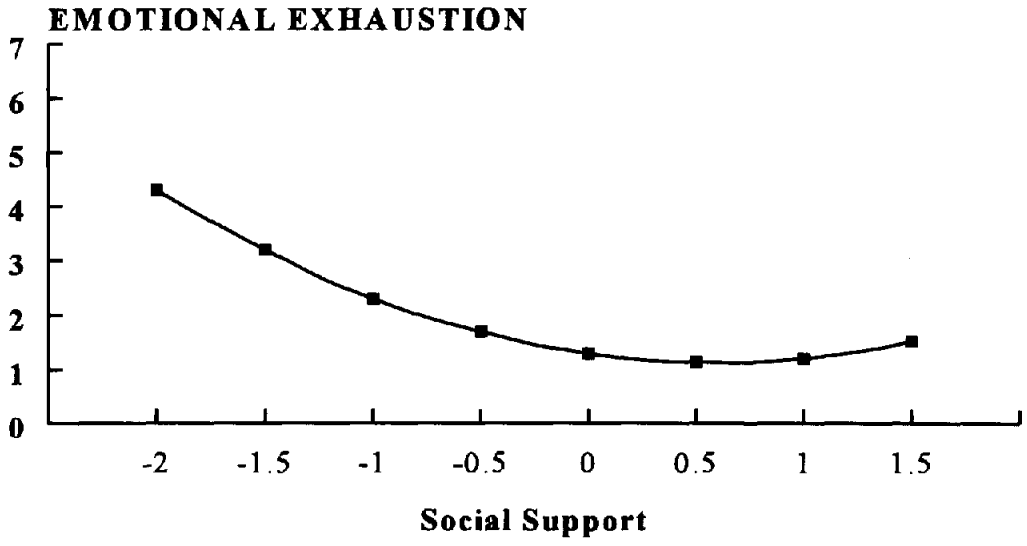

Figure 2. Graphical representation of the curvilinear relationship between social support and emotional exhaustion (N = 1,651).

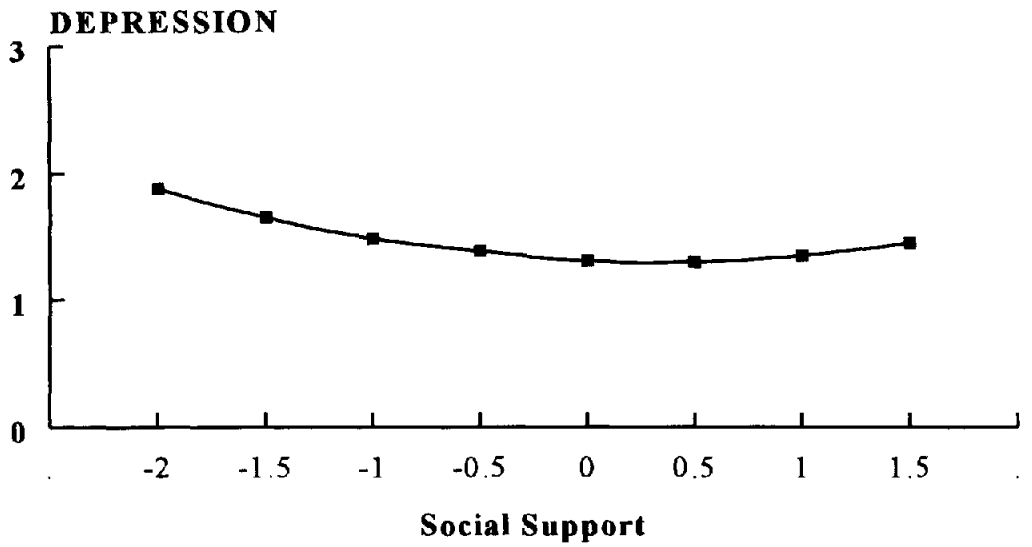

Figure 3. Graphical representation of the curvilinear relationship between social support and depression (N = 1,587).

Finally, decision authority was negatively associated with psychosomatic health complaints, as well as with the two measures of sickness absence, whereas skill discretion was not a significant predictor of any of these variables. Moreover, it may be noted that skill discretion and decision authority exerted opposite effects on these particular three outcome variables.

Post Hoc Regression Analyses: Decision Latitude

All in all, the results of the associations of both decision authority and skill discretion with the various outcome measures showed that decision authority was a stronger predictor than skill discretion (see Table 2). In addition, we conducted a series of parallel regression analyses with decision latitude (i.e., skill discretion and decision authority combined in one construct) as a predictor variable in the different models. First, the results of this parallel series of analyses revealed that the ultimate models were the same as the ultimate models shown in Table 2, with the exception of an interactive model for job satisfaction (i.e., the parallel analyses showed a Decision Latitude × Social Support interaction). Second, the results of the parallel analyses revealed that the amount of explained variance (R^2) was the same as the amount of explained variance in Table 2 for emotional exhaustion, psychosomatic health complaints, and sickness absence frequency and duration, whereas the explained amount of variance was nearly the same in case of job satisfaction (R^2 = .17) and depression (R^2 = .06). Finally, the parallel analyses showed corresponding patterns of associations compared with the patterns as can be seen in Table 2, with the exception of decision latitude, which, unlike decision authority, is not a significant predictor of psychosomatic health complaints and sickness absence duration.

Discussion

The present study contributes to job stress research by testing the DCS model to overcome several criticisms on the model. To be specific, we used a more focused measure of job control, we focused on the nature of the relationships between job characteristics and job-related strain, and we used both affective outcomes and an objectively recorded measure of employee health. Thus, the added value of the present study is in the simultaneous test of these three aspects in combination with a large representative sample.

Hypotheses

We hypothesized that job demands, job control, and workplace social support combine interactively in predicting job-related strain (as stated by Karasek,

1979) or that they are curvilinearly related to the outcome measures (as stated by Warr, 1987). Contrary to the expectation to find interactive effects when using a more focused measure of job control, we were not able to show the predicted interactive effect among job demands, job control, and workplace social support. As a consequence, our first (interactive) hypothesis is rejected. This is in contrast with some recent studies that indeed did find interactive effects using a more focused measure of control (e.g., De Jonge et al., 1996, 1999; Dwyer & Ganster, 1991; Fox et al., 1993; Wall et al., 1996). As four of the studies mentioned used a multifaceted control measure, a possible explanation for our results is that Karasek's decision authority scale is not a complete reflection of all aspects of job control. Accordingly, several authors, including Karasek (1979) himself, have suggested that it may be useful to distinguish between different aspects of job control in order to improve its measurement (e.g., De Jonge, 1995; Frese, 1989; Ganster, 1988; Jones & Fletcher, 1996). Another explanation may be the potential problem of small exposure contrast in large representative samples. Specifically, a tension exists between diversity of individual occupations (within occupational titles) and diversity in job characteristics (related to specificity of instruments). This problem outlined by Kristensen (1995, 1996) highlights less likelihood of uncovering interaction effects in such samples with small exposure on the core variables, because of regression toward the mean, and therefore less variation and less statistical power.

Furthermore, four out of six regression analyses revealed different and even opposite effects for decision authority as compared with skill discretion with respect to the outcome measures. These findings lend support to the idea about differential effects of decision authority and skill discretion on measures of job-related strain (cf. Theorell, 1989; Warr, 1994).

Limited support was found for our second (nonlinear) hypothesis. With respect to both the prediction of emotional exhaustion and depression (i.e., two out of six outcome variables), the fit of a model that includes nonlinear relations was superior to a model that includes only linear additive relations. Moreover, these nonlinear relations more or less follow the expected U-shaped pattern.

In other words, most support is found for a linear additive model in the present study. Moreover, the main effects were virtually always in the expected direction. Thus, although the three DCS constructs did not interact, the main effects nevertheless demonstrate the importance of these job characteristics in the prediction of employee health.

Registered Sickness Absence

Because we used both subjective and objective outcome measures, we had an opportunity to compare their respective relationships with job characteristics as well as the amount of explained variance. Except for skill discretion, the relationships between DCS variables and both types of outcomes were similar. The (standardized) effect sizes, however, were somewhat smaller in the case of registered sickness absence (see also Table 1). Decision authority was the only significant predictor of both duration and frequency, which is consistent with earlier research. As far as the amount of explained variance (R^2) is concerned, the ultimate models showed a similar pattern to the effect sizes: They account for $R^2 = 5\%$ in the case of each sickness absence indicator, and $R^2 = 6\%–20\%$ in the case of the subjective outcome variables. This is consistent with other studies on objectively recorded sickness absence (e.g., see Vahtera et al., 1996). Furthermore, it is also worth emphasizing that it is the self-reported measures (i.e., particularly job satisfaction and emotional exhaustion) rather than the more objectively measured outcome (i.e., sickness absence) that are better predicted by the final models. A possible explanation is that the results have been partly contaminated by common method variance or by confounding variables such as negative affectivity (e.g., Dollard & Winefield, 1998; Dormann, 1999; Zapf, 1989). Another explanation may be that sickness absence is a very complex form of behavior (cf. Kristensen, 1991; North et al., 1996). It has, for instance, a multifactorial etiology: Different factors are related to absence from work, not only the core job characteristics of the DCS model. The decision to be absent from work is also likely to be affected by factors such as risk of salary reduction, work–home interference, and social norms in the company. On the other hand, job characteristics may also play an indirect role in explaining sickness absence through job satisfaction or health complaints (cf. Beehr, 1998; Hackett, 1989; Houtman et al., 1999). A final explanation is that different job characteristics are more or less important in relation to different aspects of employee health (see Warr, 1994). In other words, not all outcomes will be affected in a similar way by a particular job characteristic.

Limitations of the Study

This study is based on a cross-sectional design and therefore precludes causal interpretation of the postulated relationships. Although the DCS model guided our hypotheses about causal relationships, hypothesized causal connections should be interpreted carefully. For this purpose, longitudinal analyses are required (see Zapf, Dormann, & Frese, 1996). Within the context of the SMASH project, such analyses are scheduled to be published in the near future. Obviously, further prospective investigation is needed to confirm and clarify the dynamics between job characteristics and job-related strain, including sickness absence. The results of the present study, however, do confirm the importance of job characteristics in relation to various aspects of employee health.

Conclusions

Three main conclusions may be drawn from this study. First, the usage of a more focused measure of job control did not lead to confirmation of the DCS model with interactive effects. In other words, decision authority neither "works better" nor "works worse" compared with decision latitude. Second, as there was some evidence of curvilinear relationships between job characteristics and job-related strain, it seems sensible to pay more attention to such associations in future research. Finally, the DCS model was not supported using a more objective outcome measure (i.e., company-administrated sickness absence).

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