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A Test and Refinement of the Demand–Control–Support Model in the Construction Industry

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This study aims at a test and further refinement of the Demand–Control–Support (DCS) model among construction workers (N = *210*). *On the basis of theory and empirical evidence, we hypothesized that mental or physical job demands, low job control, and lack of social support at work have* direct *and* synergistic *effects on burnout. The model was expanded by hypothesizing that burnout* mediates *the relationships between these potentially demanding working conditions on the one hand, and health complaints on the other. Results of a series of structural equation analyses partly supported these hypotheses. The proposed model fitted adequately to the data, although some variables in the DCS model did not make a unique contribution to explaining variance in burnout and (indirectly) health complaints. Interestingly,* lack *of social support was the most important determinant of burnout and health complaints among construction workers. In addition, a significant three-way interaction effect partly confirmed the synergism hypothesis: Physical demands were only related to burnout if participants had poor job control and reported* high *social support. The implications of these findings for research and practice are discussed.*

KEY WORDS: demand–control–support model; burnout; health; construction work.

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INTRODUCTION

Recent research on a representative sample ($N = 5{,}865$) of the Dutch working population shows that construction workers are an important at-risk group regarding exposure to physical stressors and health problems (Houtman, Smulders, Bloemhof, & Kompier, 1994). This finding is consistent with previous studies showing that construction work is relatively hazardous. For example, the likelihood of becoming disabled as a construction worker is 1.5 times that of the average Dutch employee (Corten, 1993). Moreover, the relative number of working years lost as a consequence of occupational accidents is larger in the construction industry than in any other industrial sector (Helander, 1991). It has been calculated that the number of nonfatal accidents in the construction industry is 23% of the total number of occupational accidents in The Netherlands (Urlings, Nijhuis, & Landeweerd, 1988).

The Houtman et al. (1994) study also registered a firm increase in *mental demands* in the construction industry during the 10 years preceding the study. Moreover, this increase in mental demands was stronger in the construction industry than in all other occupational groups. The presumed reason for this increase in mental demands is a more and more competitive economic environment. During the past decade, this situation has resulted in relatively high work pressure for construction workers (Limberger, 1985). Since the impact of work-related psychological stressors in the construction industry is largely unknown (Grandjean, 1986), the first aim of the present study was to examine the relationship between mental and physical job demands and other potentially demanding working conditions on the one hand, and burnout and health complaints on the other hand. The demand–control–support model was used as a theoretical framework.

The Demand–Control–Support Model

The demand–control–support model (Johnson & Hall, 1988) is an extension of the well-known job demand–control (JD–C) model (Karasek, 1979, 1989; Karasek & Theorell, 1990). The JD–C model has been developed to predict and explain work-related stress and motivation, and focuses on two important aspects of the working environment—job demands and job control. The first central prediction is that jobs characterized by high demands (i.e., work overload and time pressure) and little control (i.e., limited autonomy) evoke the strongest stress reactions or strain (e.g., physical or mental exhaustion). Consistently, according to the JD–C model, lower than average levels of strain can be expected in jobs characterized by low demands and high control. These two working conditions constitute the opposite ends of one dimension, the so-called *strain diagonal*.

A second central prediction in the JD–C model is that motivation, learning, and personal growth will be highest in jobs characterized by high demands and high control. On the other side of this *active diagonal*, one can find passive jobs, characterized by low demands and low control. Thus, the JD–C model proposes four different categories of jobs: (1) high-strain jobs (high demands, low control); (2) low-strain jobs (low demands, high control); (3) active jobs (high demands, high control); and (4) passive jobs (low demands, low control).

Although the JD–C model has acquired a prominent position in the work-related stress literature, the empirical evidence for the model is mixed, and the model has been shown to have some limitations (Baker, 1985; Carayon, 1993; De Jonge, Janssen, & Van Breukelen, 1996; Kasl, 1989; Warr, 1987). In general, epidemiological studies directed at long-term health outcomes have found more support for the model than self-report studies directed at a wide variety of stress reactions (Ganster & Schaubroeck, 1991). Recently, De Jonge and Kompier (1997) concluded that empirical evidence for the JD–C model is largely restricted to the strain diagonal. In addition, they noted that the evidence regarding the synergistic effect of job demands and job control is quite limited. Specifically, most studies fail to produce the interaction effects proposed by the JD–C model. Direct effects of job demands and job control on work-related stress reactions are more often found.

The most common criticism is that the JD–C model is *too simple*. Johnson (1989) has argued that job control is not the only resource available for coping with job demands and proposed that social support from colleagues or superiors may also function as a moderator of the relationship between job demands and stress reactions. Johnson and Hall (1988) expanded and reformulated the JD–C model by adding work-related social support as a third important aspect of the working environment. This expanded model is called the demand–control–support (DCS) model, and proposes eight different categories of jobs: Jobs characterized by the four JD–C working conditions in which employees receive *limited* social support and jobs characterized by the four JD–C working conditions in which employees receive a *large amount* of social support. A working environment characterized by limited social support is proposed to be more demanding than a highly supportive working environment. Thus, according to the DCS model, the most unfavorable and potentially stressful working environment is characterized by high job demands, low job control, and little social support.

A central issue in testing the DCS model is the *interaction* beween the three working environment characteristics that are considered: job demands, job control, and social support. A precise interpretation and operationalization of this interaction is still lacking (De Jonge & Kompier, 1997). Kasl (1996) proposes two explanations for the three-way interaction effect: (1) job control and social support both act as *moderators*, such that high levels of control and support reduce the harmful effects of job demands (i.e., buffer effects); and (2) the combination of high job demands, low job control, and little social support produces a so-called *synergistic* harmful effect. According to this latter explanation, each separate aspect of the working environment—(high) job demands, (low) job control, and (poor) social support—can cause increased stress reactions, but their combination results in an additional or synergistic effect, which is greater than the sum of the separate effects.

During the past decade, several studies have tested the DCS model, but according to a recent review (De Jonge & Kompier, 1997), the empirical evidence regarding the three-way interaction effect is still rare. If this effect is found, it is usually statistically weak and often not in the predicted direction. In part, the lack of support for the interaction effect can be ascribed to problems with research designs, operationalizations, and methodological limitations. Kristensen (1995) suggested that research on the DCS model can be improved in several ways. One of his suggestions is related to sample recruitment. Although random selection of a representative sample is generally considered a positive characteristic of descriptive research, Kristensen argues that the use of such a procedure often has unintended effects from an analytical perspective.

One example of such a side effect is that many participants face only average exposure to the potentially demanding aspects of the working environment distinguished in the DCS model. This results in low statistical power. Second, according to Kristensen (1995), there exists too much diversity in the job characteristics or working conditions because of the wide variety of jobs and occupations studied. Third, differences in socioeconomic status and health-related behaviors within the relatively large samples that have been studied are too large. The result is that the impact of these confounders on stress reactions can hardly be distinguished from potentially stressful job characteristics. A final example of a side effect of using random, representative samples is that the data can only produce limited knowledge about work-related risks for specific jobs within specific occupational fields. This state of affairs precludes clear practical recommendations based on the results of this research. Therefore, samples used to test the DCS model ideally should be *homogeneous* regarding all kinds of "disturbing" background variables, but *heterogeneous* regarding exposure to the aspects of the working environment included in the model. The second aim of this study, therefore, is to test the DCS model among a heterogeneous sample of employees working in a homogeneous occupational field, the construction industry.

The third and final issue we want to focus on in this study concerns the relationships between *specific* outcomes and the DCS variables. Several authors have criticized DCS research for its lack of specificity regarding selected outcome variables (Kasl, 1996; Kristensen, 1995). We, therefore, propose in this study to extend the regular DCS hypotheses by including a proposition directed at the outcome variables. Following Golembiewski, Munzenrider, and Stevenson (1986), potentially stressful working conditions lead to burnout, and burnout, in turn, leads to health complaints and other negative outcomes (e.g., absenteeism and impaired performance; see also Lee & Ashforth, 1996). According to this view, burnout mediates the relationships between job demands, job control, and social support on the one hand, and health complaints on the other.

Hypotheses

Our first hypothesis is that there exist direct associations between job demands, lack of job control, and lack of social support on the one hand, and burnout on the other hand (Lee & Ashforth, 1996; Schaufeli & Enzmann, 1998). Construction workers who report relatively high job demands, poor control, and limited social support from their colleagues and superiors will show elevated levels of burnout (*Hypothesis 1*).

Hypothesis 2 is based on the DCS model (Johnson & Hall, 1988) and predicts that job demands, job control, and social support will show a synergistic, interaction effect on burnout (Kasl, 1996). It must be noted that, although the main scope of the DCS model is generally directed at the psychosocial work environment and health, variables measuring exposure to other workplace characteristics, for example heavy work and noise (Kristensen, 1995), have been added to the model. In a similar vein, and consistent with our observation that mental demands are potentially important predictors of burnout in the construction industry, the present study will test the DCS model using physical job demands *and* mental job demands as predictors of burnout.

Hypothesis 3 is derived from the above-mentioned assumptions proposed by Golembiewski et al. (1986). We predict that stressful working conditions lead to burnout and that burnout, in turn, leads to health complaints. In other words, we expect that burnout plays a *mediating* role between job demands, job control, and social support on the one hand, and health complaints on the other hand (see Figure 1).

METHOD

Participants and Procedure

Participants were recruited from three middle-sized construction industry companies in The Netherlands. A total of 345 male employees were asked to fill out self-report questionnaires; 269 of them returned the completed question-

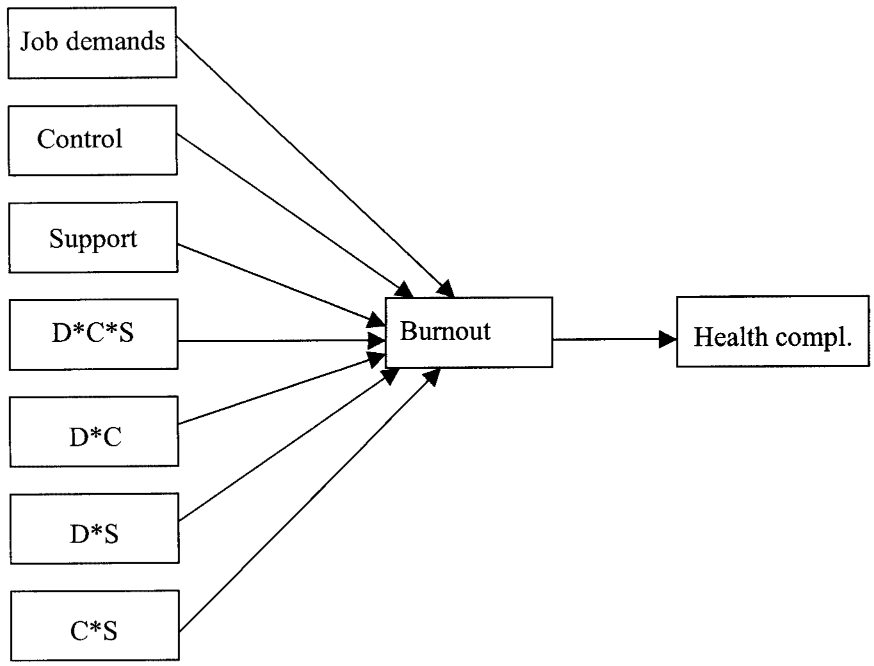

Fig. 1. The expanded DCS Model.

naire by mail (response is 78%). In the present study, we focused on the data of all 210 construction workers who could successfully be assigned to one of three different groups of jobs, namely foremen (i.e., the lowest management level at the construction site; $n = 36$), skilled construction workers (carpenters; $n = 132$), and unskilled/semiskilled construction workers (e.g., bricklayers and concrete workers; $n = 42$). Participants' ages range from 15 to 58 years ($M = 41.6$, $SD = 9.76$). We excluded both middle- and top management and the staff working at the central office (n = 59), because their work (exclusively white collar work) differs too much from the foremen, skilled, and semi/unskilled construction workers, both in work content and demands. The three selected groups of construction workers constitute a sample that is quite suitable for testing the DCS model. There are several reasons for this. First, construction work can be conceived as very demanding (Houtman et al., 1994). Second, the intended, but restricted heterogeneity of the three groups presumably results in sufficient variance in exposure to the working conditions included in the DCS model. Indeed, analyses of variance showed that the three groups differed significantly from each other regarding physical job demands, $F(2, 206) = 9.59$, $p <$

.05, mental job demands, F (2, 206) = 5.49, $p < .05$, and job control, F (2, 205) = 4.09, $p < .05$. Finally, because of the rather limited variance in socioeconomic status, an important confounder in previous studies has been eliminated.

Measures

DCS Variables

Physical Job Demands were measured with a 21-item dichotomous (yes/no) scale based on empirical work by Hildebrandt and Douwes (1991). The scale refers to several physical demands, such as carrying heavy loads, making sudden movements, working in uncomfortable positions, and the use of vibrating construction equipment. Afterwards, the answers were coded such that higher scores refer to higher physical demands. The scale's internal consistency was high: Cronbach's alpha is .95.

Mental Job Demands were measured with a 4-item dichotomous scale derived from a valid and reliable Dutch questionnaire on work and health with a yes/no answer format (Vragenlijst Arbeid en Gezondheid—VAG; Gründemann, De Winter, & Smulders, 1993). This scale in particular refers to "pressure of work." An example item is: "Do you have to work very fast?" Cronbach's alpha is .78.

Job Control was assessed with four other items from the VAG with a yes/no answer format. An example item is: "Can you personally decide upon when your work is done?." Cronbach's alpha is .73.

Social support was measured by means of a 12-item dichotomous scale referring to support from both colleagues and supervisors. This scale, like the abovementioned scales, was derived from the VAG. An example item is: "If necessary, can you appeal to your colleagues for support?" Cronbach's alpha is .82.

Outcome Variables

Burnout was measured with a Dutch translation of the Burnout Measure (BM; Pines & Aronson, 1988). This 21-item Likert scale asks participants how often they feel, for example, "tired," and "mentally exhausted." Participants could answer the questions using a 7-point scale ranging from (1) never to (7) always. Cronbach's alpha is .91.

Health Complaints were assessed with a reliable and valid Dutch questionnaire named the VOEG-21 (Dirken, 1969). The questionnaire is composed of 21 items and uses a dichotomous answer format (yes/no). An example item is: "Does your stomach bother you frequently?" Afterwards, the answers were coded such that higher scores referred to more health complaints. Cronbach's alpha is .88.

Model Testing

The DCS model was tested with structural equation modeling (SEM) using the AMOS computer program (Arbuckle, 1997). AMOS generates a chi-square goodness-of-fit statistic to test the extent to which the hypothesized model is consistent with the data. A small, nonsignificant chi-square value indicates that the model fits the data well and that the model and the data are not significantly different from each other. Jöreskog and Sörbom (1993) suggest several other fit indices to investigate the overall fit of a postulated model, including the goodness-of-fit index (GFI), the root mean square residuals (RMR), and the root mean square error of approximation (RMSEA).

AMOS provides maximum likelihood parameter estimates of the specified paths in the model, *t* values indicating the significance of the specified relationships, and so-called modification indices. The latter provide information about the relationships in a model that should be added, altered, or omitted to improve the fit between the hypothesized model and the empirical data (Hayduk, 1987). In addition, AMOS provides several fit indices that are largely independent of sample size. In the present series of analyses, the normed fit index (NFI), the incremental fit index (IFI; Bollen, 1989), and the comparative fit index (CFI) are utilized. Because of the large number of items ($n = 83$) used to operationalize all variables in our model, a simultaneous consideration of all observed variables (i.e., items) would result in underidentification problems and insufficient power of the results (Bentler & Chou, 1987). Therefore, each of the components in the DCS model—job demands, job control, social support, the interaction terms, burnout, and health complaints—were included in the structural equation model as an observed or manifest variable.

RESULTS

Descriptive Statistics

Table 1 shows the mean values, standard deviations, and intercorrelations of the variables included in this study. A first important finding is that construction workers report a lower than average burnout score ($M = 2.43$) as measured with the Burnout Measure (Pines & Aronson, 1988). Schaufeli (1990) refers to an average burnout score of $M = 3.30$ among a worldwide sample of 5,000 respondents. However, construction workers report *more* than average health

Table 1. Correlations Between the DCS Variables, Burnout, and Health Complaints, N = 210

Variables	M	SD	1	2	3	4	5	6
1. Mental Job Demands	.55	.27	—					
2. Physical Job Demands	.59	.38	.25*	—				
3. Job Control	.55	.31	.20*	.24*	—			
4. Lack of Social Support	.20	.22	.37*	.25*	.23*	—		
5. Burnout	2.43	.81	.22*	.22*	.14	.46*	—	
6. Health Complaints	4.40	4.29	.15*	.22*	.09	.36*	.54*	—

*$p < .05$.

complaints ($M = 4.40$) as measured with the VOEG. Kompier and Marcelissen (1990) report an average VOEG score of 2.71. In addition, and consistent with Hypothesis 1, the correlation matrix shows that both physical job demands and mental job demands are significantly related to burnout and health complaints. However, not consistent with Hypothesis 1 is the lack of association between job control and the two stress reactions (burnout and health complaints). Remarkable is that lack of social support shows the strongest correlations with burnout and health complaints among construction workers.

Testing the DCS Model

Hypothesis 1 states that job demands, job control, and social support show main effects on burnout. Hypothesis 2 predicts that the interaction between the three DCS variables has a unique, additional impact on burnout, after controlling for the impact of the three separate DCS variables, and the three two-way interaction terms. Hypothesis 3 predicts that burnout mediates the impact of job demands, job control, social support, and the interaction terms on health complaints. It was decided to test two versions of the DCS model: One model including physical job demands, and the second model including mental job demands.

The first model that was tested using SEM was the DCS model including physical job demands, job control, social support, each of the three two-way interaction terms, and the three-way interaction term as predictors, burnout as the mediating variable, and health complaints as the criterion. The AMOS model freed some of the coefficients of the measurement errors that were correlated, as is often the case among items with identical rating scales. They were freed in order to provide a more adequate assessment of differences in overall fit among competing models. Table 2 presents the fit indices for several models that were computed.

As can be seen in the first row of Table 2, the hypothesized model fits

Table 2. Fit Indices for the Hypothesized and Revised Models, N = 210[a]

Model	Status	χ^2	DF	p	RMR	RMSEA	GFI	NFI	IFI	CFI
Physical DCS Model	Hypothesized	16.95	15	.32	.026	.025	.983	.946	.993	.993
Physical DCS Model	Revised (+ SS-HC)	11.76	14	.63	.017	.000	.988	.962	1.008	1.000
Physical DCS Model	Revised (+SS-HC, +JD-HC)	9.22	13	.76	.007	.000	.990	.970	1.013	1.000
Null Model	No relationships	311.11	36	.00	.281	.191	.730	—	—	—
Mental DCS Model	Hypothesized	27.67	15	.02	.020	.064	.973	.925	.964	.962
Mental DCS Model	Revised (+SS-HC)	22.49	14	.07	.009	.054	.977	.939	.976	.974
Mental DCS Model	Revised (+SS-HC, +JD-HC)	22.46	13	.05	.008	.059	.978	.939	.973	.971
Null Model	No relationships	366.95	36	.00	.281	.210	.675	—	—	—

[a]χ^2 = chi-square; DF = degrees of freedom; RMR = root mean square residual; RMSEA = root mean square error of approximation; GFI = goodness of fit index; NFI = normed fit index; IFI = incremental fit index; CFI = comparative fit index; SS = social support; HC = health complaints; JD = job demands.

quite well to the data. Moreover, sample size independent fit indices have values close to 1, indicating a very good fit. A closer examination of the *t* tests for significance of the path coefficients revealed that the *t* values were above the critical level of 1.96 for the path from physical job demands ($\gamma = .15$; $p < .05$), lack of social support ($\gamma = .46$; $p < .05$), and the three-way interaction term ($\gamma = .21$; $p < .05$) to burnout, and for the path from burnout to health complaints ($\beta = .54$; $p < .05$). However, the path coefficients for the other relationships in the model were not significant (all *t* values < 1.96).

Despite the adequate overall fit of the model, the modification indices showed that the fit could be improved by adding the direct path from social support to health complaints. The fit of this revised model (see second row in Table 2) was significantly better than the fit of the hypothesized model, χ^2 (dif) = 5.19, df = 1, $p < .05$. Finally, because the correlational analysis had shown that there exists a bivariate relationship between physical job demands and health complaints, we examined an alternative model in which this path was added (see third row in Table 2). The chi-square difference test showed that this modification did *not* increase the fit of the model to the data, χ^2 (dif) = 2.55, df = 1 $p > .05$. Moreover, the coefficient of the direct path from physical job demands to health complaints was not significant ($\gamma = .10$, $t < 1.96$).

Taken together, these results partially support our hypotheses. In the revised model, including the path from lack of social support to health complaints ($\gamma = .13$; $p < .05$), physical job demands ($\gamma = .15$; $p < .05$), lack of social support ($\gamma = .46$; $p < .05$), and the three-way interaction term ($\gamma = .21$; $p < .05$) all have independent and significant relationships with burnout and explain a substantial amount of the variance in burnout scores ($R^2 = .25$). Burnout, in turn, is positively related to health complaints ($\beta = .46$; $p < .05$), and explains 31% of its variance. However, job control and the two-way interaction terms show no unique relationships with burnout or health complaints (all standardized coefficients < .10; $p > .05$).

In a second series of structural equation analyses, the expanded DCS model was tested using *mental* job demands, job control, social support, each of the three two-way interaction terms, and the three-way interaction term as predictors, burnout as the mediating variable, and health complaints as the criterion. Again, the AMOS model freed some of the coefficients of the measurement errors that were correlated. As can be seen in Table 2, the hypothesized model adequately fits to the data. However, a closer examination of the *t* tests for significance of the path coefficients revealed that only two paths in the model were significant, namely the path from lack of social support to burnout ($\gamma = .46$; $p < .05$) and the path from burnout to health complaints ($\beta = .54$; $p < .05$). Thus Hypotheses 1 and 2 regarding mental job demands are rejected. There exists no direct relationship between mental job demands and burnout, and no interactive effect of this variable with job control and social support.

The modification indices suggested that the fit of this model could also be improved by adding the direct path from lack of social support to health complaints ($\gamma = .15$; $p < .05$). The fit for this revised model (see Table 2) was indeed significantly better than the fit of the hypothesized model, χ^2 (dif) = 5.18, df = 1, $p < .05$. In this revised model, lack of social support also has a strong and independent relationship with burnout ($\gamma = .46$; $p < .05$), and burnout, in turn, is positively related with health complaints ($\beta = .47$; $p < .05$). Finally, because the correlational analysis had shown that there exists a bivariate direct relationship between mental job demands and health complaints, we examined a final alternative model in which this path was added (see Table 2). However, the chi-square difference test showed that this modification did *not* increase the fit of the model to the data, χ^2 (dif) < 1, df = 1 $p < .05$. Moreover, the coefficient of the direct path from mental job demands to health complaints was far from significant ($\gamma = .01$; $t < .1.96$).

The main hypothesis in the DCS model is that job strain is a multiplicative function of job demands, job control, and social support. The results of the structural equation analyses showed that the interaction between *physical* job demands, job control, and social support indeed had a significant and independent impact on burnout. To examine the direction of this three-way interaction effect, we decided to plot the regression equation (see Aiken & West, 1991). Following Cohen and Cohen (1983), values of the predictor variables (low vs. high) were chosen one standard deviation below and above the centered mean. Simple regression lines were then generated by entering these values in the regression equations. The results of the computation of these regression equations are graphically presented in Figure 2.

The upper plot in Figure 2 suggests that physical job demands have a positive impact on burnout when participants have limited control over their work (and not when they have high control). Note, however, that these effects are only found under conditions of *high* social support from colleagues and supervisors. This is not consistent with the DCS model, because theory predicts that social support could have further buffered the impact of job demands on burnout when job control is limited. In addition, under conditions of limited social support, a quite different picture emerges. The lower plot in Figure 2 suggests that under these conditions, physical job demands only have a positive impact on burnout when job control is high. Put differently, job control has a negative impact on burnout, but only under conditions of relatively *low* job demands. This reversed interaction effect between physical demands and control on burnout, under conditions of limited social support, is unexpected and seems counterintuitive. However, a consistent finding is that physical job demands have the predicted positive impact on burnout, but only when low control coincides with high support, or when high control coincides with low social support.

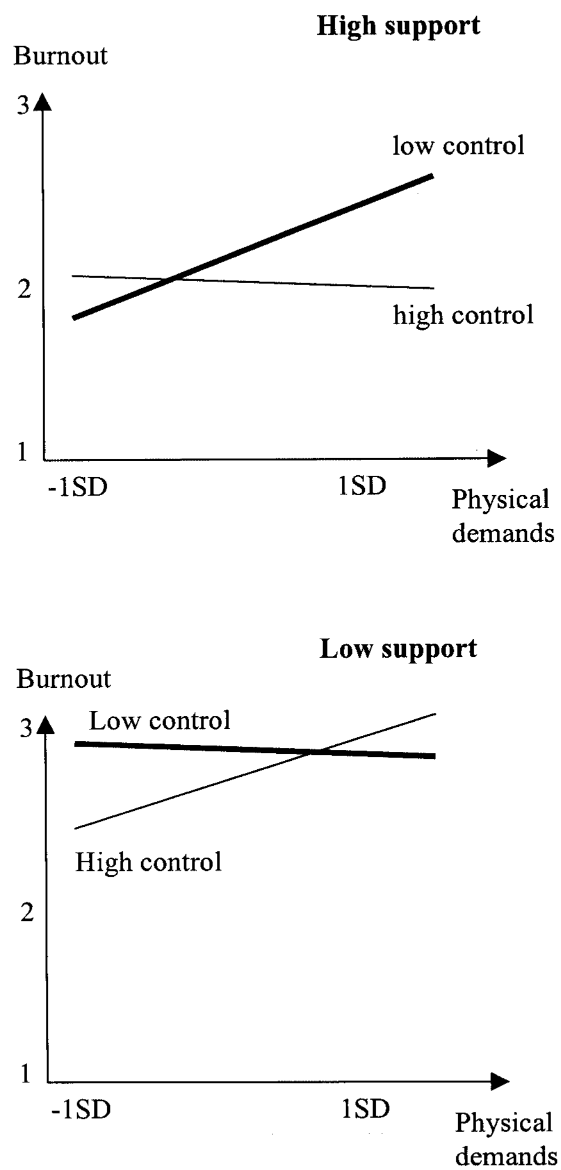

Fig. 2. Three-way interaction effect: Burnout as a function of physical job demands, job control, and social support.

CONCLUSIONS AND DISCUSSION

This study aimed to test and refine the DCS model (Johnson & Hall, 1988) among a heterogeneous group of construction workers. This is a group of employees who has received little attention in the work and stress literature. First, we investigated the extent to which mental and physical job demands, job control, and lack of social support were predictive of burnout, as measured by Pines and Aronson's (1988) Burnout Measure (Hypothesis 1; see also Lee & Ashforth, 1996; Schaufeli & Enzmann, 1998). Simultaneously, we examined the synergistic effect of job demands, job control, and social support on burnout, as a further test of the DCS-model (Hypothesis 2; see also Kasl, 1996). Further, we proposed that stressful working conditions can lead to burnout, and that burnout, in turn, may result in health complaints (Golembiewski et al., 1986). According to this refined model, burnout is expected to *mediate* the relationships between job demands, job control, and social support on the one hand, and health complaints on the other (Hypothesis 3). The introduction of this extension was suggested in order to better understand the pattern of associations between the DCS variables and stress outcomes. In sum, in order to test the refined DCS model integrally, this study introduced a process model in which job demands, job control, lack of support, and their interaction terms predict burnout, which, in turn, predicts health complaints.

A first important finding is that social support was negatively related to burnout and health complaints. This result suggests that construction workers may benefit substantially from adequate interpersonal relationships at work. The important role of social support from colleagues and superiors found in the present study is in line with many other studies regarding social support and work-related stress (Cohen & Wills, 1985; De Jonge & Kompier, 1997; Lee & Ashforth, 1996; Schaufeli & Enzmann, 1998). However, unlike findings in many other occupational groups, neither *mental* job demands nor job control had a unique effect on burnout or health complaints (see De Jonge & Kompier, 1997, and Kristensen, 1995, for reviews). Furthermore, physical demands only showed a relatively weak relationship with burnout and no direct relationship with health complaints. Thus Hypothesis 1 was only partly supported by our results. The lack of association between mental job demands and burnout or health complaints is a remarkable finding. A possible explanation for this result might be that, in spite of the reported increase in mental demands in construction work (Houtman et al., 1994), these mental demands are still less predominant in the experience of the daily work life among construction workers, compared with other stressors like physical demands or impaired interpersonal relationships. In addition, one might speculate that the latter factors are still being perceived as a more legitimate (traditionally accepted) explanation for health complaints or exhaustion among construction workers. Another possible (methodological) explanation for this finding might be that part of the mental job demands are in fact associated with impaired social relations (see correlations in Table 1). Social support, the strongest predictor of burnout and health complaints, may as such explain part of the shared variance between mental job demands and both stress reactions. A possible reason for the finding that physical demands were not clearly associated with health complaints is the *healthy worker effect*: Construction workers suffering from specific health complaints (like musculoskeletal disorders) are frequently (at least temporarily) assessed as work disabled. The disabled workers did not participate in this study. The remaining group, presumably reporting less severe (psychosomatic) and/or less specific health complaints, may indeed associate such complaints (in part) with low social support or even conflicts.

Pertaining to the issue of mediation, the results of the SEM analyses suggested that a model in which burnout acts as a mediator between work-related stressors (i.e., physical job demands, lack of social support), and health complaints fits well to the data (Hypothesis 3). Notwithstanding the latter, the AMOS program suggested that the model fit would improve substantially if a direct path between social support and health complaints were added. The importance of including this relationship suggests that mediation by burnout is substantial but incomplete. In other words, social support not only influences health complaints through its effect on burnout, but also in a *direct* way. This partial mediation effect of burnout is consistent with Golembiewski et al.'s (1986) research.

The hypothesis regarding the synergistic effects of job demands, control, and support on the stress outcomes was partly supported by the results. A significant three-way interaction effect showed that burnout is a multiplicative function of physical job demands, job control, and social support. However, the interaction effect was not in all respects unequivocal. Construction workers reporting high support but low control showed a firm increase in burnout when physical demands increased. In contrast, those reporting high control in a highly supportive environment did not experience an increase in burnout when physical demands increased. This stress-buffering effect is in line with theory (Karasek & Theorell, 1990). However, when support was low, construction workers did not seem to benefit from job control. Those employees reporting low support and high control experienced an increase in burnout when physical demands increased; construction workers reporting low control and low support, on the contrary, reported no increase in burnout when physical demands increased.

Taken together, these results suggest that support somehow influences the extent to which control can act as a buffer (moderator) of the impact of physical job demands on burnout. One can only speculate about the reason for this pattern of results. One possible explanation for the interaction effect is that a supportive environment allows or stimulates workers to actually use additional strategies to cope with physical demands, allowing job control to act as a buffer. In contrast, a working environment that is characterized by little support from one's colleagues may foster an unsafe workplace in which high job control is perceived as a condition in which one is left to his own devices. Such a situation may even be stress-provoking. Further research in this direction is needed, however.

Limitations of this study should be noted as well. First, like all cross-sectional research, this study does not provide a firm basis for drawing causal inferences. Second, with respect to the interaction analysis, Kenny and Judd (1984) have noted that products of normally distributed variables cannot be multinormally distributed themselves. This means that the assumption of multivariate normality may have been violated when the interaction terms were entered in the equation. Third, a problem with self-report data is that they may be contaminated by common-method variance, because both the independent and the dependent variables are based on one source of information, that is, the participants (Kemery, Mossholder, & Bedeian, 1987). However, in general, there exists a fairly high consistency between objective and subjective ratings of variables such as those used in the present study (Spector, 1987).

In sum, the present study contributes to the work and stress literature in five respects. First, the DCS model was tested using mental *and* physical job demands among construction workers, a group of employees that has largely been neglected in studies on psychosocial stress. Second, the results emphasize the importance of social support pertaining to the stressor-strain relationships, and thereby validate the extension of the JD–C model (Karasek, 1979) with a social support dimension (Johnson & Hall, 1988). Third, the results suggest that mental job demands and job control are not necessarily related to burnout in every category of employees (several reasons were mentioned), and that physical job demands can contribute to the emergence of burnout (this relationship was, however, not very strong). Fourth, we found some evidence regarding the hypothesis that job demands, job control, and social support show a synergistic effect on stress outcomes. Like many other studies (De Jonge & Kompier, 1997), however, our results were not totally in line with theory. Finally, the present study clearly suggests that burnout can mediate (in part) the relationships beween working characteristics and health complaints. This latter finding is a refinement of our insights into the relationships between job-related stressors and stress reactions.

An important practical implication of this study is based on the finding that construction workers seem to benefit substantially from adequate social relationships with their colleagues and superiors. In order to prevent or reduce work-related stress and health complaints, more attention to this issue is recommended—especially in light of the observation that construction workers today are exposed to increasing job demands. Interventions aimed at the improvement of social support at work may be equally important as interventions aimed at optimizing physical job demands and safety in order to reduce burnout and to improve health. Programs in this direction that have been successfully implemented among construction workers are, for example, the improvement of communication structures and the implementation of "discussions of progress" (Lendfers, Nijhuis, De Jong, & Janssen, 1996).

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