Stressful work, sickness absence and turnover in truck drivers from etiology to prevention

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Chapter 2

Job stress and psychosomatic health complaints in Dutch truck drivers:
A re-evaluation of the interactive Demand-Control model
Chapter 2 Re-evaluation of the JDC Model

Abstract

Background Karasek’s Job Demand-Control Model (JD-C Model) assumes that decision latitude (job control) moderates the impact of psychological job demands on health and well being. It was proposed that lack of evidence for this core ‘interaction hypothesis’ was a consequence of an inadequate conceptualization of decision latitude (job control).

Objectives considering this proposition, we re-evaluated the JD-C Model in a sample of 517 Dutch truck drivers.

Results Regression analyses revealed a significant psychological job demands by job control interaction effect as well as significant main effects of the two independent variables on psychosomatic health complaints. However, the magnitude of the interaction effect was very small.

Conclusions The interaction hypothesis was not supported in the present study.

Introduction

The last decades a number of models were developed in order to explain the relation between the psychosocial work environment on the one hand, and health and well being on the other hand. One of the most influential models is Karasek’s Job Demand-Control Model (JD-C Model) (Karasek, 1979). Karasek’s JD-C Model assumes that the interaction of two aspects of the psychosocial work environment, viz. psychological job demands (workload and other job stressors) and decision latitude (skill discretion and decision authority), determine health and well being. The model supposes that the occurrence of high psychological job demands in work situations results in adverse strain reactions such as fatigue, physical illness and coronary vascular disease only when levels of decision latitude are low. Stated differently, the JD-C Model assumes that decision latitude moderates the negative effect of psychological job demands on health and well being. This core assumption of the JD-C Model is commonly referred to as the 'interaction hypothesis'.

A large number of studies have been conducted to test the JD-C Model. According to Jones and Fletcher (1996), these studies can be categorized into three types. The first type are large scale epidemiological studies, examining differences between occupations in long term health outcomes, in particular cardiovascular symptoms (for reviews see Karasek and Theorell, 1990; Schnall and Landsbergis, 1994; Theorell and Karasek, 1996). These studies found moderate support for Karasek’s interaction hypothesis. The second type of studies takes a between-subject approach. A majority of these studies involved a single occupation and investigated a range of health and well-being outcomes at a shorter time scale (e.g. job satisfaction, and symptom perception) (e.g. Payne and Fletcher, 1983; Spector, 1987; McLaney and Hurrell, 1988; Landsbergis, 1988; Warr, 1990; Dwyer and Ganster, 1991; Carayon, 1993; Fletcher and Jones, 1993; De Jonge and Landeweerd, 1993; Furda et al., 1994; De Jonge et al., 1996; Bourbonnais et al., 1996; 1998.) Only a small number of these studies confirmed Karasek’s interaction hypothesis. The third type of studies looked at the immediate short-term effect of psychological job demands and decision latitude, either within or between-subjects. The few studies of this type have provided some support for the interaction hypothesis (Perrewé and Ganster, 1989; Fox et al., 1993).

Overall, it can be concluded that the majority of the above studies found significant main effects of psychological job demands and decision latitude. However, the interaction effect has been demonstrated less consistently. Besides methodological aspects of the studies —
the use of different statistical procedures, and the use of different populations— a more fundamental aspect might explain the inconsistent results. This fundamental aspect involves the conceptualization of Karasek's decision latency (Wall et al., 1996). It has been suggested (Ganster, 1988; Ganster and Fusilier, 1989; Wall et al., 1996) that the construct of decision latency is too broad as it embodies skill discretion as well as decision authority. In view of the available laboratory evidence (Steptoe and Appels, 1989), it seems that job control (decision authority) moderates the effects of psychological job demands on health. Job control allows workers to meet job demands when, and how they find most acceptable. This leads to a less threatening appraisal of psychological job demands and a healthier coping style. Consequently, the stressful impact of psychological job demands is reduced.

Although studies examining the JD-C Model have directed their attention more and more at the possible moderating effect of job control (decision authority), this has not been accompanied by an adequate measure (Wall et al., 1996). Up to now, most researchers have kept using measures of the broad decision latitude construct, which include items about job control as well as items about learning opportunities, opportunities to be creative, variety and skill utilization.

Recently, Wall et al. (1996) demonstrated the predicted interaction effect using a focused measure of job control (Wall et al., 1995) while parallel analyses using Karasek's broad measure of decision latency failed to demonstrate the interaction effect. However, the job control by cognitive job demands interaction effect was very small as it appeared to explain about 1 per cent of the variance of the outcome variables. Sargent and Terry (1998) replicated Wall's study and found a more pronounced interaction effect. Under high levels of task control, quantitative workload was positively associated with affective well being. Contrary to Sargent and Terry, De Rijk et al. (1998) and Schreurs and Taris (1998) recently failed to replicate Wall's findings. Thus, so far this topic remains undecided.

The aim of the present study was to re-evaluate the interactive JD-C Model by using, in line with the above-mentioned studies, a theoretically more adequate measure of job control.
Methods

Subjects
The study population consisted of 1,000 Dutch truck drivers. The population of truck drivers seems to be suitable to test the JD-C model. Truck driving is found a stressful profession characterized by, among other things, time pressure, and irregular and long working hours and monotony (McDonald, 1984; Bos et al., 1984; Hedberg et al., 1993). In two recent studies truck drivers reported elevated levels of stress-related symptoms (Orris et al., 1997; Kuiper et al., 1998). Thus, it seems that stress-related health problems pose a serious problem in the profession of truck driving.

In order to obtain a heterogeneous population, a random sample of truck drivers was taken from the directory of the Central Bureau of Occupational Health Care in Road Transport (BGZ Wegvervoer) (n = 500), four Trade Unions (n = 350) and three industrial companies (n = 150). Of the 1,000 mailed questionnaires, 534 were returned (a rate of 55%) of whom 517 had completed the questionnaire totally.

Questionnaire
All subjects were administered a questionnaire including items on demographic variables, job demands, job control and psychosomatic health complaints. Demographic variables included age, educational level and number of truck driving years. Psychological job demands (quantity and intensity of the job) were assessed by an eight-item scale derived from the JCQ (Karasek, 1985), which consisted of the following items: "no time to finish work", "psychologically demanding job", "excessive work", "job requires working fast", "have adequate time to do work" (reversed), "job requires working hard", "hectic job", and "job requires working over-time". Items were scored on a four-point Likert scale, ranging from 'never' (0) to 'always' (3). Internal scale reliability of this sub-scale was good (Cronbach's alpha = 0.84). Job control was assessed by items of the original Karasek questionnaire that are clearly focused on control itself and do not encompass elements such as skill use and task variety. This yielded the following six items: "freedom as how to work", "have say over what happens", "have influence over the way work is planned", "exert influence over work pace", "have control over time order", and "determine breaks oneself". Items of this scale were, in the same manner as 'psychological job demands', scored on a four-point Likert scale. Internal scale reliability was satisfactory (Cronbach's alpha = 0.72). Psychosomatic health complaints were assessed by a general health questionnaire (VOEG) (Dirken, 1969). This questionnaire measures general somatized psychosocial problems (Visser, 1983). The VOEG consists of 21 dichotomous items on
complaints with respect to general fatigue, the stomach, the musculoskeletal system, and the cardiovascular system. The VOEG is widely used in the Netherlands, for instance in the Netherlands Health Interview Survey by the Central Bureau of Statistics. Internal scale reliability is good (Cronbach’s alpha = 0.86) and test-retest reliability is satisfactory (Pearson’s r = 0.76) (Van Sonsbeek, 1990). Validity of the VOEG was found within limits as it correlated moderately with the Hopkins Symptom Checklist (HSCL) (Van Sonsbeek, 1990).

Statistical analysis

To detect main and interaction effects of psychological job demands and job control on psychosomatic health complaints stepwise multiple regression analyses were performed. The independent variables were entered into the equation in four successive steps. In the first step, number of truck driving years was entered to control for a possible confounding effect. To examine main effects, psychological job demands and job control were entered into the equation in the second and third step, respectively. In the fourth and final step, the interaction term was entered to test the predicted interaction effect of psychological job demands and job control on psychosomatic health complaints. The test for the interaction effect is based on the variance explained by the cross product over and above that accounted for by the main effects. Regression analyses are considered an appropriate technique to test interaction (Cohen and Cohen, 1984). However, since the interaction term is a combination of two independent variables, the risk of multi-collinearity is high (Jaccard, 1990). To avoid the problem of multi-collinearity, psychosomatic health complaints were regressed on the interaction term of the standard scores of psychological job demands and job control. All analyses were performed using SPSS 7.5 for Windows.

Results

Table 1 displays the descriptive statistics and correlations between the variables used in the study. Inspection of Table 1 reveals a moderate negative association between psychological job demands and job control ($r = -0.28$, p < .01). Further, psychological job demands correlates relatively strongly with psychosomatic health complaints ($r = 0.48$, p < .01). A relatively small correlation was found between job control and psychosomatic health complaints ($r = -0.24$, p < .01). Concerning the demographic variables only age showed a significant, but small correlation with both job characteristics and strain (psychosomatic health complaints) ($r = -0.12$, p < .01; $r = -0.10$, p < .05 respectively). Number of truck driving years showed a significant, but small correlation with
psychosomatic health complaints ($r = .14, p < .05$). Thus, possible confounding effects of the demographic variables on the association between job characteristics and psychosomatic health complaints were not expected to be strong.

**Table 1** Mean (M), standard deviation (SD), range and correlations among the study variables 
($n = 517$)

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Age</td>
<td>36.2</td>
<td>9.8</td>
<td>19-60</td>
<td>.88</td>
<td>.01</td>
<td>.02</td>
<td>.24</td>
</tr>
<tr>
<td>2.</td>
<td>Truck driving years</td>
<td>13.2</td>
<td>9.9</td>
<td>0-40</td>
<td>.88</td>
<td>.01</td>
<td>.02</td>
<td>.24</td>
</tr>
<tr>
<td>3.</td>
<td>Psychological job demands</td>
<td>11.2</td>
<td>4.7</td>
<td>2-24</td>
<td>.01</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Job control</td>
<td>8.5</td>
<td>3.7</td>
<td>0-18</td>
<td>.12</td>
<td>.08</td>
<td>.28</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Psychosomatic complaints</td>
<td>4.5</td>
<td>4.5</td>
<td>0-20</td>
<td>.11</td>
<td>.14</td>
<td>.48</td>
<td>.24</td>
</tr>
</tbody>
</table>

$r \geq .15, p < .01$

The results of the stepwise multiple regression analyses are shown in Table 2. As can be seen from Table 2 a significant and substantive increase in $R^2$ occurred by the second step when psychological job demands were entered into the regression (from .02 to .25, $p < .01$). Introduction of job control in step three resulted in a small but significant increase of $R^2$ (from .25 to .26, $p < .025$). The introduction of the interaction term (demands x control) in step four revealed a further small but significant increase of $R^2$ (from .26 to .27, $p < .05$).

**Table 2** Stepwise multiple regression analyses of job demands, job control and the cross product of job demands and job control ($n = 517$)

<table>
<thead>
<tr>
<th></th>
<th>Step one</th>
<th>Step two</th>
<th>Step three</th>
<th>Step four</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>Sign.</td>
<td>$\beta$</td>
<td>Sign.</td>
</tr>
<tr>
<td>1.</td>
<td>Truck driving years</td>
<td>.14  **</td>
<td>.13  **</td>
<td>.13  **</td>
</tr>
<tr>
<td>2.</td>
<td>Psychological job demands</td>
<td>.48  **</td>
<td>.45  **</td>
<td>.62  **</td>
</tr>
<tr>
<td>3.</td>
<td>Job control</td>
<td>-1.0  *</td>
<td>.10  n.s.</td>
<td>.24  *</td>
</tr>
<tr>
<td>4.</td>
<td>Demand x control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.02</td>
<td>.25</td>
<td>.26</td>
<td>.27</td>
</tr>
</tbody>
</table>

Significance of increment

* $p < .05$
** $p < .01$

**Discussion**

The present study was conducted to re-evaluate Karasek's Job Demand-Control model among a group of Dutch truck drivers. As recommended by Ganster (1988) and recently by Wall and colleagues (1996), we tested the model by using only those items of Karasek's decision latitude measure that assess opportunities provided by the job to exert...
control over job demands. Alike Wall et al. (1996) we found a statistically significant job demands by job control interaction. However, the explained variance by the interaction effect, over and above that of the main effects, was very small (0.7 per cent to be exact). Although the interaction effect may have been somewhat underestimated due to measurement error, self-report bias, common method variance and restriction of range of the job characteristics in our study population we do not consider this result as strong support for the interactive JD-C model. In our opinion, the size of the interaction effect is neither of theoretical nor of practical significance.

Concerning the main effects of the two job characteristics, the predictions made from the JD-C Model were partially supported. Significant main effects for both psychological job demands and job control on psychosomatic health complaints in the predicted direction were found. However, the association between psychological job demands and psychosomatic health complaints was much stronger than the association between job control and psychosomatic health complaints. Hence, the direct effect of job control on psychosomatic health complaints appeared to be small either. These findings correspond to a number of other studies in which it was found that, in general, job control shows a weak association with health complaints (Spector, 1987; Carayon, 1993; Furda et al., 1994; Houtman et al., 1994; De Rijk et al., 1998; Schreurs and Taris, 1998). Just recently, Sparks and Cooper (1999), in a large heterogeneous population, found a small correlation between job control and physical health ($r = 0.24$) as well.

Karasek (1979) supposed that job control and psychological job demands are independent variables. Therefore, the relatively high correlation between psychological job demands and job control ($r = -0.28$) needs some consideration. A possible explanation for this interrelationship is that truck drivers with high levels of (perceived) job control may exercise that control to make their job less demanding. Considering the results of a Dutch qualitative study by Bos et al. (1984) in our opinion the reverse explanation is more plausible. In this study it appeared that high levels of psychological job demands due to among other things tight time schedules are a cause rather than a consequence of decreased control opportunities of the work (flexibility).

Since perceived psychological job demands in the present study were strongly associated with perceived psychosomatic health complaints, an efficient intervention to prevent or reduce psychosomatic health complaints among Dutch truck drivers may be found in decreasing their workload. Yet, decreasing workload simultaneously affects productivity. Hence, on the short term this kind of intervention appears unpopular from an employer's
point of view. However, given the fact that stress related health complaints may cause loss of productivity (Jex, 1998), sickness absence (Niedhammer et al., 1998) and turnover (Horn and Griffeth, 1995), interventions aimed at decreasing workload, for instance by employing more workers, may be effective on the long term from a psycho-social as well as a financial-economic perspective. Cost-benefit analyses conducted within the road haulage industry may elucidate this rather complex matter.

Another possible intervention to ameliorate truck driver’s health is to increase levels of job control. However, based on the results of this study the effects are not expected to be strong. Moreover, as job control shows a relatively high correlation with psychological job demands it remains to be seen whether increasing job control without simultaneously decreasing psychological job demands can be put into practice. That is, increasing job control may be difficult given the tight time schedules in the road haulage industry that are required to keep productivity up (Bos et al., 1984). On the other hand, when the interrelationship between psychological job demands and job control implicates that truck drivers with high levels of control can make their job less demanding by working more efficiently, increasing job control may have a direct as well as an indirect positive effect on the health of truck drivers. Obviously, the possible mechanisms and effects of these different kinds of stress reducing interventions should be evaluated in future studies.

In addition, future studies should investigate the effects of control over different aspects of the work environment. Karasek in his original publication (Karasek, 1979) pointed to the importance to distinguish between different aspects of job control. However, most studies - including the present - have used a global measure of job control. Studies by McLaney and Hurrell (1988), Jimmieson and Terry (1996) and Sargent and Terry (1998) are an exception. It appeared from these studies that different types of job control (e.g. control over decision making, control over work schedules, and control over resources, control over task aspects, and control over the physical environment) may have different effects on health and well-being. Moreover, it appeared from the Sargent and Terry study that some types of job control moderated the effects of certain types of job demands, whereas others did not. Hence, it may be that, depending on the type of job (demand) under consideration, different types of job control are differentially related to health and well being. Discriminating between different types of job demands and job control seems a useful elaboration on the JD-C Model. For instance, considering truck drivers long and irregular working hours, control over work schedules (determining own working hours, opportunities to take vacations, days off when desired etc.) may be a relevant type of job control for these workers. Work schedule control enables truck drivers to more efficiently
coordinate job demands with non-job demands. Also, increased levels of work scheduling control may allow truck drivers to stop health complaints such as over-fatigue from advancing by taking 'preventive' days off.

Finally, more longitudinal studies are required as these studies provide a firmer basis for making causal inferences. Above that, in longitudinal studies the effects of losses and the effects of gains of control can be examined. As Ganster (1988) mentioned, examining losses in control is meaningful because losses of control may have a stronger negative effect on health than never having had control (see also Mineka and Henderson, 1985).

In conclusion, despite the use of a more precise measure of job control, the results of the present study failed to support the hypothesis of an interaction between psychological job demands and job control. Moreover, only perceived psychological job demands were found to be substantially related to experienced psychosomatic health complaints. These findings suggest that the JD-C Model is insufficient to explain the work-strain relation. In our opinion, the model is too non-specific. Therefore, attention in future research should be directed at the longitudinal investigation of the (combined) impact of a range of occupation specific job demands and job control aspects. Two global job characteristics seem insufficient.