Job demands, health perception and sickness absence

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Background	Investigation of the relations between job demands, health and sickness absence is required to design a strategy for the prevention of absence and disability.
Aim	To study the relationships between (physical and psychological) job demands, health perception and sickness absence.
Methods	Prospective study of 414 male employees working in two organizations with low company absence levels. Job demands and health were examined using the Basic Occupational Health Questionnaire. Sickness absence was followed for 1 year thereafter. The number of days and episodes of absence were counted.
Results	The questionnaires of 247 workers (60%) were suitable for statistical analysis. Physical job demands ($r = 0.41$; $P < 0.01$) and, to a lesser extent, psychological job demands ($r = 0.16$; $P = 0.01$) were related to the number of health complaints. Short (1–7 days) duration absence was neither related to job demands nor to the number of health complaints. Longer (>7 days) duration absence was positively related to psychological job demands and to the number of health complaints.
Conclusions	Job demands, particularly physical demands, correlated with perceived health. Poor health predicted long-term sickness absence. Early recognition of poor health should be the basis of a strategy that prevents long-term sickness absence.
Key words	Occupational health; psychological job demands; physical job demands; sickness absence; working conditions.

Introduction

Sickness absence is a major public health problem and has important consequences for companies in terms of lost productivity, costs of insurance and employment replacement. Marmot *et al.* [1] investigated the relation between self-reported health and sickness absence and found strong associations between ill-health and sick leave. The presence of a long-term disease is a strong predictor [odds ratio 2.36; 95% confidence interval (CI) 1.29–4.29] for sickness absence [2]. Hansson and Jensen [3] concluded that self-reported pain and functional impairments were associated with a higher risk of long-term absence. They identified heavy physical workload, bent or twisting working positions, and prior absence as factors having limited but consistent influence on the risk of sickness absence.

Psychosocial factors such as job control and decision latitude are related to absence [4–8]. The relation between psychological job demands and sickness absence remains unclear. Vahtera *et al.* [6] reported that increased demands caused a higher risk of sick leave. Head *et al.* [9] found increased demands predicted a higher incidence of long-term sickness absence, compared with stable job demands. In the GAZEL cohort, three psychosocial work factors (psychological demands, decision latitude and job support) were followed-up prospectively, and the results were reported after 1 year [5] and 6 years [8]. Low levels of decision latitude and social support were significant predictors of sickness absence, but psychological job demands were not. Hanebuth *et al.* [10] confirmed that psychological job demands were unrelated to absenteeism.

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Previously, administrative workers who reported multiple health complaints were found to be at increased risk of future sickness absence [11]. Neither physical nor psychological job demands predicted absence, which was attributed to occupational selection bias. The present study investigated sickness absence in relation to job demands and health perception, controlling for occupation.

Methods

Dutch occupational law obliges companies to offer a health check to their personnel every 4 years. In the year 2002, our regional Occupational Health Department performed health checks in two companies: an insurance company ($n = 144$) and a cheese-producing industry ($n = 270$). The results of the health checks in these two companies were used for this study.

The company absence level is a measure for the absence management in an organization. It was calculated as:

$$\frac{\text{Total number of days absent on company level corrected for part-time return-to-work}}{\text{Total number of workers in the company} \times 365 \text{ calendar days}} \times 100\%$$

The company absence level was 5.2% in the insurance company, and 5.5% in the cheese-production industry, meaning that both companies had comparable absence levels. The company absence frequency is regarded as a measure for absence behaviour in an organization. It was calculated as:

$$\frac{\text{Total number of new periods absent in the company in the year of study}}{\text{Total number of workers in the company}}$$

The company absence frequency was 1.05 periods per worker in the insurance company and 1.03 periods per worker in the cheese-producing company, implying that both companies had comparable absence frequencies.

The health check included the Basic Occupational Health Questionnaire, a series of biometrical measurements and physical examination. Sickness absence in the year following the health check was registered. Ethical approval was sought from the Medical Ethics Committee of the University Medical Center Groningen, who advised that ethical clearance was not required. All workers gave informed consent and agreed to report their results on group level.

The Basic Occupational Health Questionnaire is a valid and reliable [12] self-completed questionnaire consisting of 116 questions about health complaints, diseases and recent medical treatment, as well as perceived working conditions, organizational climate and interpersonal workplace relationships. Factor analysis of the questionnaire using Varimax rotation, revealed several uni-dimensional sub-scales. For this study, we used the sub-scales health complaints (22 specific complaints; Cronbach's alpha $\alpha = 0.83$), physical job demands (eight items considering physical exertion, heavy lifting, repetitive movements, regular bending, regular twisting, regular high reaching and lengthy working in a sitting or standing position; $\alpha = 0.60$), psychological job demands (six items considering mental exertion, lengthy concentration, time pressure, work piling up, work difficulty and overtime working; $\alpha = 0.64$), job support [eight items considering organization of the work (two items), supervisory support (two items), co-worker support (two items), workplace atmosphere and feedback; $\alpha = 0.70$] and job autonomy (three items considering being able to organize work, interrupt work and make decisions concerning one's job; $\alpha = 0.63$). All sub-scale items could be scored present ($=1$) or absent ($=0$) from which scores were computed for each sub-scale.

Sickness absence data were retrieved from our computerized occupational health registration files. The first and last dates of all absences were registered. The total number of days absent in the follow-up period was computed for each employee. According to the Whitehall II study [4], the number of short (1–7 days) and longer (>7 days) periods of absence was counted on the individual level.

The data were analysed using SPSS for Windows, version 14. Among the industrial workers were three women. To exclude gender effects, we decided to study the questionnaires which were completed by male officers and industrial workers. Their educational level ranged from 1 (none or primary school) to 6 (university). It was recoded into three variables: low (level 1, 2 or 3), medium (level 4) and high (level 5 and 6). In the statistical analysis, low and medium educations were included as dummy variables relative to high education. Data are presented as mean $\pm$ standard deviation and significance is concluded for $P < 0.05$.

The number of periods absent is a form of count data. Poisson regression is often used to analyse count data [13]. The Poisson distribution can be used to model the number of occurrences of an event or the rate of occurrence of an event as a function of the independent variables. Poisson distributions have some special features. Firstly, the Poisson distribution is skewed, whereas traditional (i.e. least squares) regression assumes a symmetric distribution. Poisson regression implicitly uses a log-transformation which adjusts for the skewness and also prevents the model from producing negative predicted values. Finally, the Poisson regression models the variance as a function of the mean, whereas traditional regression assumes a constant variance. In Poisson regression it is assumed that the dependent variable y has a distribution, given the independent variables $x_1, x_2, \ldots, x_i$:

$$P(y = k|x_1, x_2, \ldots, x_i) = e^{-\mu} \mu^k/k!, \text{ with } k=0, 1, 2, 3, \ldots$$

where the log of the mean μ is assumed to be a linear function of the independent variables:

$$\log(\mu) = \text{intercept} + b_1{*}x_1 + b_2{*}x_2 + \ldots + b_i{*}x_i.$$

The Poisson distribution implies that the variance is equal to the mean (μ).

The Poisson model was a good fit for the number of long periods absent [likelihood ratio (LR) = 169; $P = 0.98$] but not for the number of short periods (LR = 236; $P = 0.09$). The variance in the number of short periods was greater than the mean, resulting in a dispersion that was greater than predicted by the Poisson model. A negative binomial distribution is an alternative model for counts. It can be derived quite naturally from the Poisson distribution, but has a variance which is larger than the mean. To test for an improvement of fit, the Poisson distribution was compared to the negative binomial distribution [14] estimated with transition data analysis (version 6.4f). The negative binomial distribution proved to be a better fit for the number of short periods absent.

Therefore, the relation between job demands, health and short periods of absence was investigated using the negative binomial distribution in which short periods absent was the outcome variable, and all independent variables (age, educational level, company, number of health complaints, physical job demands, psychological job demands, job support and job autonomy) were entered simultaneously into the model. The relation between job demands, health and long periods of absence was analyzed accordingly, using the Poisson distribution.

Results

The two organizations employed 414 men between them. Eighty-two workers did not participate in the study: nine non-participants were on sick leave at the time of health check; the others mentioned no interest ($n = 39$), regular medical control ($n = 22$) or privacy considerations ($n = 12$) as reasons for their refusal to participate. The non-participants had a mean age of 45.2 ± 7.5 years. They were absent for 26.7 ± 51.9 (median 6) days in the follow-up period and had 1.1 ± 1.3 (median 1) periods of absence.

The questionnaires of 69 participants had to be excluded: 61 questionnaires were anonymous and 8 were not complete. Another 16 workers were excluded because they resigned their job ($n = 4$), were pensioned off ($n = 9$) or remained sicklisted at the end of the follow-up period ($n = 3$). The questionnaires of 247 workers (60%) were suitable for statistical analysis. These subjects had a mean age of 43.7 ± 10.1 years, were absent for 17.3 ± 38.4 (median 3) days and had 1.1 ± 1.2 (median 1) periods of absence. They reported a mean level of physical demands

of 0.91 ± 1.47 (range 0–8); the mean level of self-reported psychological demands was 1.59 ± 1.28 (range 0–6). The perceived job support was 6.76 ± 1.69 (range 0–8) and the job autonomy was 2.53 ± 0.71 (range 0–3).

The subjects mentioned 2.78 ± 3.19 health complaints. The number of health complaints was positively related to physical job demands ($r = 0.41$; $P < 0.01$) and psychological job demands ($r = 0.16$; $P = 0.01$), and was negatively related ($r = -0.26$; $P < 0.01$) to job support, as is shown in the correlation matrix of the independent variables (Table 1).

The total number of periods absent was unrelated to both physical [rate ratio (RR) = 1.03; 95% CI 0.89–1.19] and psychological (RR = 1.02; 95% CI 0.86–1.22) job demands. The number of periods absent in the follow-up period was predicted by the number of self-reported health complaints: RR = 1.08; 95% CI 1.02–1.15 ($P = 0.02$). Neither job demands nor the number of health complaints were related to the number of short periods of sickness absence (Table 2).

The rate of longer periods of absence was positively associated with psychological demands and the number of health complaints, as shown in Table 3.

The strong relation between the number of health complaints and long periods of absence might mask the effect of job demands on sickness absence. Therefore, we performed a backward regression step, excluding the number of health complaints from the regression model. The exclusion of health complaints reduced the statistical fit significantly (log likelihood = 11.2; df = 1; $P < 0.001$) but did not alter the results.

Discussion

The positive relation between the number of health complaints and the number of periods absent is in accordance with previous findings [11] and confirms the association between poor health and sick leave [1,15]. The number of self-reported health complaints predicted longer

Table 1. Correlations between the independent factors

Variables	1	2	3	4	5	6
Age						
Educational level	−0.26**					
Health complaints	0.09	−0.15*				
Physical demands	0.09	−0.27**	0.41**			
Psychological demands	0.09	0.13	0.16*	0.12		
Job support	0.06	0.05	−0.26**	−0.14*	−0.19**	
Job autonomy	0.07	0.29**	−0.11	−0.11	0.00	0.11

Correlations between the independent factors in all participants ($n = 247$). The table shows Pearson product-moment correlation coefficients.

*$P < 0.05$ and **$P < 0.01$ (two-tailed significance).

Table 2. Relation between job demands, health and short (1–7 days) periods of absence

Independent variables	Short (1–7 days) periods of absence
Age	0.98 (0.95–1.01)
Low education[a]	0.65 (0.27–1.57)
Medium education[a]	0.33 (0.14–0.83)*
Company[b]	2.34 (1.15–4.78)*
Number of health complaints	1.05 (0.96–1.14)
Physical demands	1.12 (0.93–1.35)
Psychological demands	0.90 (0.72–1.13)
Job support	0.97 (0.83–1.13)
Job autonomy	1.25 (0.86–1.83)

The association of job demands and health complaints with short periods of sickness absence investigated using a negative binomial distribution. The table presents the rate ratios (95% CIs);

*$P < 0.05$ and **$P < 0.01$.

[a]Relative to high education.

[b]The insurance company was registered as 0, and the cheese-producing industry as 1.

Table 3. Relation between job demands, health and long periods of absence

Independent variables	Long (>7 days) periods of absence	
	Regression model (health included)	Regression model (without health)
Age	1.00 (0.97–1.03)	1.00 (0.97–1.03)
Low education[a]	1.48 (0.40–5.52)	1.29 (0.33–5.05)
Medium education[a]	1.10 (0.30–4.13)	0.94 (0.23–3.63)
Company[b]	4.76 (2.01–11.31)**	4.94 (2.04–11.98)**
Number of health complaints	1.12 (1.05–1.20)**	
Physical demands	0.91 (0.76–1.09)	0.99 (0.84–1.15)
Psychological demands	1.30 (1.04–1.62)*	1.31 (1.06–1.62)*
Job support	1.09 (0.93–1.25)	1.00 (0.88–1.15)
Job autonomy	0.77 (0.56–1.07)	0.76 (0.55–1.03)

The association of job demands and health complaints with long periods of sickness absence investigated using a Poisson regression model. The table presents the rate ratios (95% CIs);

*$P < 0.05$ and **$P < 0.01$.

[a]Relative to high education.

[b]The insurance company was registered as 0, and the cheese-producing industry as 1.

(>7 days) periods of absence but was unrelated to short (1–7 days) periods absent. The Whitehall II study of British civil servants has shown a strong association between indicators of ill-health and sickness absence, particularly for longer spells of absence [1].

In contrast with earlier research [2,3], physical job demands predicted neither short nor long periods of absence. We suspected that health complaints encompassed the effects of job demands, suggesting a possible problem of intermediate effects: demands resulting in health complaints with subsequent sickness absence. Exclusion of health complaints from the regression model, however, did not reveal a relation between physical job demands and absence. An alternative explanation for the finding that physical job demands were unrelated to sickness absence was sought in the low scores of the sub-scale, indicating that the perceived physical load was low in our study population. It is conceivable that relationships between physical job demands and sickness absence exist in companies with physically demanding work or poorer working conditions [16].

Psychological job demands predicted longer periods of absence, which affirms the results of Head et al. [9]. In line with the results from the GAZEL cohort, we found no relationship between psychological demands and sickness absence when the total number of periods absent was considered. The correlation between psychological job demands and sickness absence seems to depend on how the latter is measured. This finding could explain the contradictory reports on the relation between psychological demands and sickness absence. The practical importance of these ambiguous findings, however, should be investigated in more detail.

The number of health complaints was positively related to physical job demands, confirming the results of Laaksonen et al. [17] who showed physical workload to be associated with both general and mental health. They reported that workers with the poorest working conditions mentioned poor health two to three times more often than those in the upper occupational classes. Schrijvers et al. [18] explained that a substantial part of the association between occupational class and ill-health in the working population could be attributed to a differential distribution of physical working conditions.

An alternative explanation for the strong association between physical job demands and health arises from differences in socioeconomic class. It has been reported that Dutch people with lower socioeconomic status have poorer health [19] and are more likely to work in laborious work. In our analysis, we controlled for educational level which is considered a proxy of socioeconomic class. Short periods of absence were related to educational level but not to health. Longer periods of absence were related to health and occupation, even when educational level was controlled for. Rahkonen et al. [20] concluded that both social class and working conditions were related to health after mutual adjustments.

In terms of potential weaknesses of the study, we achieved a response rate of 60% and bias due to selective non-response cannot be ruled out. Non-participants had more days absent and were probably more likely to be chronical as 22 of them were under regular medical follow-up. Our study was not anonymous, which could have influenced the results. However, socially desirable

responses would underestimate rather than overestimate the relationships found.

The reliabilities of both job demands scales were low. This is explicable from the different types of demands, which are not necessarily related. For instance, the worker reporting prolonged sitting will not mention prolonged standing as a work strain, whereas both were considered physical demands. We do not think this will have biased our results because factor analysis has shown both demand scales to be uni-dimensional.

Finally, the results were not representative for the total working population as we only studied male workers to control for gender differences in sickness absence behaviour [5]. Moreover, we restricted our research to two large companies to obtain homogenous occupational groups and bypass the effects of organizational changes. In line with the results of Piirainen *et al.* [16], it is possible that the investigation of companies with more demanding work or poorer working conditions yields different results.

We concluded that job demands, particularly physical demands, were related to perceived health. Our results indicate that early recognition of poor health is a better basis for a strategy to prevent long-term sickness absence than measurement of job demands. Periodic occupational screening for health among active workers could identify workers at increased risk of long-term absence. Further research should focus on dose–response relationships between job demands and health. If such dose–response relationships exist, then lowering workload becomes an important issue in workplace health risk management.

Key points

- Job demands, particularly physical demands, correlated with perceived health.
- Psychological job demands were related to long-term absence and poor health predicted long-term absence.
- Periodic screening of health perception among active workers identifies workers at increased risk of long-term absence.

Conflicts of interest

None declared.

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