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Work stress and health effects among university personnel

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Abstract Objective: (1) To investigate the contribution of job characteristics and personal characteristics to the explanation of health effects among university personnel; (2) to investigate the differences between scientific personnel (SP) and non-scientific personnel (NSP); (3) to investigate whether health effects occurred one after another. **Methods:** The well being at work of employees at a Dutch university ($n=2,522$) was investigated by means of a questionnaire. A model was constructed in which several job and personal characteristics were set out against health effects. The latter were assumed to occur in phases: decreased “job satisfaction” as an early effect, followed by increased “tension” and “emotional exhaustion”, and possibly also by increased “perceived health complaints”. The contribution of job and personal characteristics to the explanation of health effects was investigated by means of linear regression analysis, with separate analyses for SP and NSP. **Results:** Positive job characteristics, especially professional expertise and work variety, contributed to the explanation of “job satisfaction”. The major contributors to “tension” and “emotional exhaustion” were negative characteristics, such as work pressure. Besides the negative aspects, the major contributors to the explanation of “perceived health complaints” were sex, age and other health effects. In NSP, social support contributed to the explanation of “tension” and “emotional exhaustion”, but not in SP. The explained variance of “job satisfaction” by the positive job characteristics in NSP was much higher than that in SP. To investigate whether health

effects occurred one after another, we considered explained variance. Explained variance in “job satisfaction” was much higher than in “perceived health complaints”. “Emotional exhaustion” and “tension” were in between. **Conclusions:** Contrary to expectations, decision latitude and social support played only minor roles. Also, the differences between SP and NSP were smaller than expected. As individual condition and burden of outside work also influence health effects, we recommend the inclusion of relevant personal factors in future studies.

Keywords Work stress · Health effects · University personnel

Introduction

In research into the relationship between (psychological) workload and well being, the Job Demand Control model developed by Karasek (1979) has frequently been used. This model assumes that psychological stress reactions in the workplace can chiefly be explained by high job demands and low job decision latitude. A combination of these two job characteristics is assumed to have a stronger effect on health and well being than either of the two separately (Karasek 1979; De Jonge and Furda 1995; De Jonge et al. 1996; Van der Doef 2000). Johnson and Hall (1988) extended the model, with a third dimension, into the Job Demand Control Support model. This model predicts that a combination of high job demands, low job decision latitude and low social support from colleagues and superiors has the most negative consequences on a person's health. Many studies have shown that (job) stressors can lead to health effects. They form a risk for, e.g., high blood pressure, cardiovascular disease, decreased resistance and musculoskeletal complaints. Major psychological disorders include tension, depression, fatigue and emotional exhaustion. In the long term, these complaints can lead

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to a person being incapacitated for work (Kompier and Marcelissen 1990; Kompier and Houtman 1995). Karasek's model also makes another assumption: so-called active jobs, i.e. high job demands and high decision latitude, can give rise to intrinsic motivation, learning effects and personal growth (De Jonge and Furda 1995; De Jonge et al. 1996). However, a study by Van Veldhoven et al. (1999) showed that particularly employees with a relatively high score for work pace, work quantity and autonomy in their work reported the most tension-related complaints.

The Dutch literature describes a variation on the job demand control support model: the model "workload" (Van Dijk et al. 1990). This model has a global character and its level of specification depends on the application. Figure 1 shows a specification in which work-related and personal factors are linked with health effects. In the model, distinction is made between (early) signs/symptoms and health effects (Van Dijk et al. 1990; Kompier and Houtman 1995). Figure 1 also makes this distinction: workload firstly leads to a feeling of poor well being at work, followed by increased tension and emotional exhaustion, and possibly also by an increase in perceived health complaints.

University employees are often divided into scientific personnel and non-scientific personnel. Compared with the latter group, scientific personnel hold a different

position: although their work pace is high, they often regard their work as being challenging and interesting, with high decision latitude and autonomy (Houtman et al. 1994). In Karasek's model (1979) this group falls under the "active jobs"; it can be assumed that these persons run less risk of negative health effects than persons who have highly demanding jobs with less decision latitude and less interesting work.

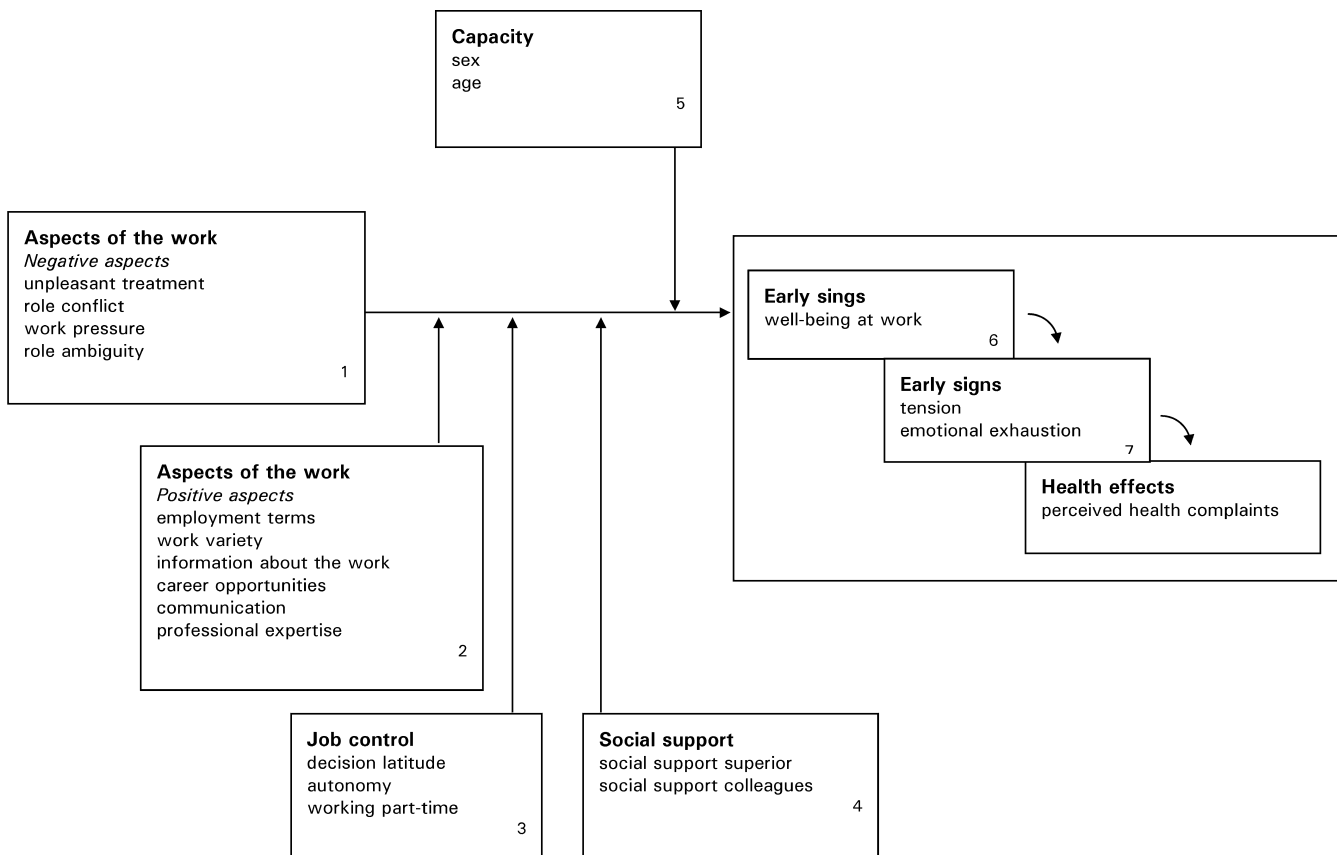
In this study, we made an inventory of the work-related factors, personal factors and health effects among scientific and non-scientific employees at a Dutch university. Our aim was to investigate which work-related and personal factors contributed to an explanation for the health effects and whether there were differences between scientific and non-scientific personnel. In addition, we investigated whether health effects occurred in phases. For this purpose, secondary analyses were performed on existing data collected within the framework of an occupational risk assessment.

Methods

Questionnaire and population

Within the framework of the risk assessment, a questionnaire was sent to 4,642 employees in all units (i.e. faculty departments and services) at a Dutch university in the period 1996 to 1998. The questionnaire, called the well-being survey, comprised six sections that contained the various scales. The corresponding number of items and Cronbach's alpha are given between parentheses.

Fig. 1 Assumed relationship between work-related factors and personal characteristics versus health effects



Personal characteristics: questions on gender, age, education level, employment category (2 questions), part-time or full-time employment.

Work content: work variety (3; 0.67), work pressure (8; 0.87), professional expertise (2; 0.87), autonomy (10; 0.89).

Task content: role conflict (5; 0.73), role ambiguity (5; 0.79), information about the work (3; 0.74).

Work relationships: social support from superiors (5; 0.87), social support from colleagues (5; 0.80), communication (4; 0.87), decision latitude (9; 0.87), unpleasant treatment/discrimination (7; 0.68).

Employment terms: employment terms (5; 0.62), career opportunities (3; 0.66).

Health and well being: perceived health complaints (10; 0.75), tension (4; 0.90), emotional exhaustion (4; 0.86), well being at work (comprising 3 items: challenging work, involvement and satisfaction; 0.70).

Internal consistency was fair to good (De Jonge et al. 1995). Cronbach's alpha was <0.70 only for work variety, unpleasant treatment/discrimination, employment terms and career opportunities.

During the construction of the well-being survey, we aimed to produce a questionnaire that was well suited to the specific employment circumstances and work relationships within a university. For this purpose we used scales from various existing and validated questionnaires: the Maastricht risk assessment questionnaire (work variety, professional expertise) (De Jonge 1994); the Maastricht autonomy questionnaire (work pressure, autonomy) (De Jonge et al. 1995); questionnaire "Organisation Stress-D" (role conflict, role ambiguity, social support from superiors, social support from colleagues, tension) (Bergers et al. 1986); questionnaire on perception and evaluation of work (information about the work, communication, decision latitude) (Van Veldhoven and Meijman 1994; Van Veldhoven and Broersen 1999). The questions in the health and well-being section were derived from a study on psychological health by De Jonge et al. (2000), which used sources such as the Psychosomatic Complaints Scale (perceived health complaints) (Dirken 1969) and the Maslach Burnout Inventory (emotional exhaustion) (Schaufeli et al. 1996). No questions were asked about physical working circumstances (furnishings, indoor climate, physical workload), because they were judged by systematic inspection. These data could not be linked to the questionnaire data.

At the request of the occupational health service (OHS), the well-being questionnaire was distributed among the employees in each unit. Employees could return the well-being survey anonymously to the OHS in the envelope provided. When the questionnaires had been received, the answers were entered optically per unit. If the response rate was less than 60–70%, the employees were reminded about the well-being survey by e-mail or during a staff meeting.

Analyses

In order to check for selective non-response, we compared the sex and age of the respondents with these characteristics in the personnel database in the period corresponding with the well-being survey, using the χ^2 test.

For each respondent, we calculated scores by adding the items in each scale and dividing by the number of items in that scale. Figure 1 shows the relationship between the work-related and personal factors and the health effects; the scales have been grouped into blocks. In the work-related factors, distinction was made between negative aspects (factors expected to have a negative influence) and positive aspects (a positive influence is expected). Working hours (i.e. part-time or full-time) could, in principle, be placed at various locations within the model. In our opinion it can best be placed under job control: it is a way of regulating the work pressure and is not, per definition, a positive or negative aspect of work. The personal factors sex and age were placed under "capacity" (Van Dijk et al. 1990).

In the first phase of the analyses using stepwise linear regression analysis (De Vocht 1997) we investigated, per block, the correlation between each scale and the dependent variables "early symptoms"

and "health effects". If no significant correlation was found (i.e. $P \geq 0.05$), the scale was removed from the analysis (data not presented). In the second phase, the blocks were added to the model in the order described above. Step 1 comprised stepwise linear regression analysis to investigate the correlation between the negative aspects of the work and the health effects. Step 2 also included the positive aspects. In step 3, job control was added, in step 4, social support, and in step 5, personal aspects, which represent capacity. "Well being at work" was also included in the analyses with "tension" and "emotional exhaustion" as dependent variables. In the last phase, in the model with "perceived health complaints", the three early symptoms were entered as independent variables. In order to detect whether health effects occurred in phases, we investigated the percentage of explained variance.

Stepwise linear regression analysis was performed on the following separate populations:

- Non-scientific personnel (NSP), i.e. administrative staff, analysts, technicians or others (not belonging to the scientific staff).
- Scientific personnel (SP), i.e. PhD students, senior university lecturers, professors and other scientific personnel.

Analyses were performed with the statistical program SPSS 9.0 for Windows.

Results

In total 2,529 questionnaires were returned (response rate 54%); seven could not be used and were withdrawn from the analyses. Table 1 shows some personal characteristics of the respondents. Comparison with the personnel database showed selective non-response: relatively more women ($\chi^2 = 8.09$; $P = 0.004$) and fewer persons younger than 25 years ($\chi^2 = 57.53$; $P < 0.001$) returned the questionnaire.

Table 2 shows means and range of the scales in the two populations. There were significant differences between the NSP and SP (t -test; $P < 0.05$). The most relevant differences were found for professional expertise, well being at work, autonomy, work variety and career opportunities. SP always had a higher score than NSP.

Tables 3 and 4 show the results of linear regression in the NSP and SP populations, respectively. In the scales from the block "negative aspects of the work", we expected a negative correlation with the dependent variable "well being at work" (in this case, a higher score on the independent scale would correlate with a lower score on "well being at work") and a positive correlation with the remaining dependent variables (a higher score on the independent scales would correlate with a higher score on "tension", "emotional exhaustion" and "perceived health complaints"). In the scales from the block "positive aspects of the work", "job control" and "social support", the opposite situation applied: we expected a positive correlation between these scales and "well being at work" and a negative correlation with the other dependent variables. The tables show only the correlations with a P value of < 0.05 .

In the first phase, working hours had a negative correlation with "well being at work" (part-time work was associated with less "well being at work" in the NSP) and "emotional exhaustion" (part-time work in NSP and SP was associated with less "emotional

Table 1 Personal characteristics of the personnel in percentages

Characteristics		Non-scientific (n = 1,417)	Scientific (n = 1,105)		
Sex	Male	49.3	69.5		
	Female	50.7	30.5		
Age	< 25 years	4.0	4.4		
	26–35 years	23.1	35.9		
	36–45 years	31.3	27.2		
	46–55 years	31.1	22.3		
	> 55 years	10.3	10.2		
Educational level	Primary school/low secondary education	10.1			
	Intermediate secondary education	26.0			
	Higher secondary education	41.1	0.4		
	University	22.8	99.6		
Job description		40.7	Administrative	48.3	Faculty
		7.5	Analyst	22.6	PhD student
		16.2	Technical	29.1	Other
		35.6	Other		
Part-time work	Yes	43.1	37.8		
	No	56.9	62.2		

Table 2 Overview of the scales in the well-being questionnaire

Scale	Range	Mean (SD)		t Value
		NSP (n = 1,417)	SP (n = 1,105)	
Unpleasant treatment ^a	1–4	1.08 (0.20)	1.08 (0.17)	NS
Role conflict ^a	1–4	1.66 (0.45)	1.66 (0.46)	NS
Work pressure ^a	1–5	3.11 (0.74)	3.28 (0.71)	–5.93
Role ambiguity ^a	1–4	1.92 (0.58)	2.03 (0.55)	–4.43
Employment terms ^b	1–5	3.37 (0.69)	3.31 (0.80)	2.22
Work variety ^b	1–5	3.18 (0.75)	3.46 (0.63)	–9.85
Information about the work ^b	1–4	2.99 (0.65)	3.16 (0.59)	–6.44
Career opportunities ^b	1–5	2.51 (0.84)	2.78 (0.94)	–7.46
Communication ^b	1–4	2.74 (0.70)	2.75 (0.74)	NS
Professional expertise ^b	1–5	3.99 (0.89)	4.45 (0.63)	–14.92
Decision latitude ^b	1–4	2.62 (0.62)	2.79 (0.61)	–6.64
Autonomy ^b	1–5	3.37 (0.79)	3.76 (0.63)	–13.58
Social support from superiors ^b	1–4	3.24 (0.67)	3.22 (0.67)	NS
Social support from colleagues ^b	1–4	3.25 (0.56)	3.26 (0.51)	NS
Well being at work ^b	1–5	3.67 (0.78)	4.10 (0.65)	–14.21
Tension ^a	1–4	1.79 (0.68)	1.93 (0.72)	–4.87
Emotional exhaustion ^a	1–5	1.81 (0.72)	1.86 (0.71)	NS
Perceived health complaints ^a	1–3	1.44 (0.35)	1.35 (0.30)	7.09

^aOn these scales, a higher score is unfavourable

^bOn these scales, a higher score is favourable

exhaustion”), but in the later analyses no significant correlation was found; results of the item “working hours” are, therefore, not presented. Only the results of “well being at work” have been included in their entirety in the tables as an example. Not all results are presented for the other dependent variables.

Well being at work

Significant correlations were found between “well being at work” and the positive aspects professional expertise, work variety and career opportunities: a higher score on these scales was associated with greater “well being at work”. In addition, a strong correlation was found with the negative aspect role conflict. Contrary to our expectations, high work pressure was associated with greater “well being at work”. In the SP this correlation was no longer significant after job control had been added. There was a difference between NSP and SP regarding “decision latitude”: the correlation in NSP

was stronger than in SP. In SP, in contrast to NSP, a significant but weak correlation was found for social support from superiors. After we had added the positive aspects in step 2 the correlations with the negative aspects became weaker. The percentage of explained variance was considerably larger in this step. Increases in explained variance in the subsequent steps were negligible. The percentages of explained variance in the last step for NSP and SP were 54% and 41%, respectively.

Tension

The strongest correlations were found between the negative aspects work pressure or role conflicts and “tension”. The correlation with work pressure was stronger in SP than in NSP. In both populations, “well being at work” was associated with less “tension”. This was also stronger in SP than in NSP. The positive effects and job control hardly played a role. Correlations with social support from superiors and colleagues were only

Table 3 Results stepwise linear regression analysis on NSP ($n = 1,417$). *SNI* scale not included, on the basis of the first phase of the analyses, *SI* scale included, but the correlation was not significant ($P > 0.05$)

Aspects of the work	Well being at work					Tension					Emotional exhaustion				Perceived health complaints				
	Step 1 β	Step 2 β	Step 3 β	Step 4 β	Step 5 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 7 β	
Negative aspects ^a																			
Unpleasant treatment	SNI	SNI	SNI	SNI	SNI	0.10	0.08	0.08	0.08	0.10	0.09	0.07	0.07	0.20	0.19	0.15	0.15	0.11	
Role conflict	-0.27	-0.11	-0.11	-0.11	-0.12	0.25	0.19	0.19	0.18	0.19	0.13	0.13	0.11	0.06	SI	SI	SI	SI	
Work pressure	0.23	0.10	0.07	0.08	0.08	0.15	0.16	0.15	0.17	0.31	0.31	0.32	0.36	0.14	0.14	0.13	0.13	SI	
Role ambiguity	-0.20	-0.09	-0.07	-0.07	-0.06	0.12	0.06	0.07	0.07	0.06	SI	SI	SI	SNI	SNI	SNI	SNI	SNI	
Positive aspects ^b																			
Employment terms		0.08	0.05	0.05	0.06	-0.07	SI	SI	SI	-0.11	-0.09	-0.09	-0.07	-0.08	-0.07	-0.08	-0.08	SI	
Work variety		0.29	0.25	0.25	0.25	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	-0.13	-0.13	-0.12	-0.12	-0.09	
Information about the work		0.06	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SNI	SNI	SNI	SNI	SNI	
Career opportunities		0.13	0.11	0.11	0.11	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	-0.10	-0.10	-0.08	-0.08	-0.07	
Communication		0.07	SI	SI	SI	SI	SI	SI	SI	-0.07	SI	SI	SI	SI	SI	SI	SI	SI	
Professional expertise		0.32	0.30	0.30	0.30	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	
Job control ^b																			
Decision latitude			0.21	0.21	0.20	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Autonomy			SI	SI	SI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	
Social support ^b																			
Support superior				SI	SI	-0.10	-0.10	-0.09	-0.09	-0.11	-0.11	-0.09	-0.09	SI	SI	SI	SI	SI	
Support colleagues				SI	SI	-0.11	-0.10	-0.10	-0.10	-0.12	-0.11	-0.11	-0.11	-0.10	-0.10	-0.10	-0.10	SI	
Capacity																			
Gender					SNI	SNI	SNI	SNI	SNI	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Age					SI	0.06	0.06	0.06	0.06	SNI	SNI	SNI	SNI	0.16	0.16	0.16	0.16	0.15	
Early signs																			
Well being at work						-0.07	-0.07	-0.07	-0.07	-0.12	-0.12	-0.12	-0.12	SI	SI	SI	SI	SI	
Emotional exhaustion																		0.31	
Tension																		0.24	
R ²	0.16	0.51	0.53	0.53	0.54	0.22	0.24	0.25	0.25	0.31	0.33	0.33	0.34	0.14	0.15	0.17	0.17	0.33	

^aNegative correlation with “well being at work”: *higher* score on work-related scale was associated with *less* “well being at work”. Positive correlation in the other columns: *higher* score on the work-related scales was associated with *more* “tension”, “emotional exhaustion” and “perceived health complaints”

^bPositive correlation with “well being at work”: *higher* score on work-related scale was associated with *more* “well being at work”. Positive correlation in the other columns: *higher* score on the work-related scales was associated with *less* “tension”, “emotional exhaustion” and “perceived health complaints”

significant in NSP. The only positively correlated personal factor was age in NSP: more advanced age was associated with greater “tension”. This step was not analysed in SP, because no significant correlations had been found earlier.

The negative aspects made the greatest contribution to the explained variance: in NSP and SP, the percentages of explained variance in the first step were 22% and 26%, respectively. In the last step, these rates were 25% and 30%, respectively.

Emotional exhaustion

Negative aspects chiefly explained “emotional exhaustion”. In both populations the strongest correlation was with “work pressure”. In addition, “well being at work” played a role: a higher score was associated with less “emotional exhaustion”. In NSP significant correlations were found with “support from superiors and

colleagues”. The positive aspects and job control hardly played a role. In the first phase of the analyses none of the personal factors in SP played a role; therefore, step 5 was not carried out. In NSP, only sex was added, but it had no significant influence in the second phase.

As was the case with “tension”, the negative aspects in step 1 made the greatest contribution to the explained variance in “emotional exhaustion”: in NSP and SP, 30% and 33%, respectively. In the last step, these rates were 34% and 38% explained variance.

Perceived health complaints

In the last step, in particular, “tension” and “emotional exhaustion” contributed to the explanation for “perceived health complaints”. In SP, the correlation with “tension” was stronger; in NSP this applied to “emotional exhaustion”. In addition, sex played a marked role: women reported more perceived health complaints

Table 4 Results stepwise linear regression analysis on SP ($n = 1,105$). SNI scale not included, on the basis of the first phase of the analyses, SI scale included, but the correlation was not significant ($P > 0.05$)

Parameter	Well being at work					Tension					Emotional exhaustion				Perceived health complaints				
	Step 1 β	Step 2 β	Step 3 β	Step 4 β	Step 5 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 2 β	Step 4 β	Step 5 β	Step 6 β	Step 7 β	
Negative aspects ^a																			
Unpleasant treatment	SNI	SNI	SNI	SNI	SNI	0.12	0.09	SNI	0.10	0.07	0.05	SNI	0.06	0.14	0.13	0.11	0.11	0.07	
Role conflict	-0.30	-0.14	-0.14	-0.12	-0.12	0.23	0.18	SNI	0.16	0.12	0.16	SNI	0.14	0.08	SI	0.08	0.08	0.08	SI
Work pressure	0.14	0.06	SI	SI	SI	0.22	0.24	SNI	0.25	0.32	0.32	SNI	0.34	0.16	0.16	0.16	0.16	0.16	SI
Role ambiguity	-0.27	-0.12	-0.10	-0.08	-0.08	0.13	SI	SNI	SI	0.12	0.07	SNI	SI	0.07	SI	SI	SI	SI	SI
Positive aspects ^b																			
Employment terms		SI	SI	SI	SI	SI	SI	SNI	SI	-0.10	-0.09	SNI	-0.08	-0.09	-0.09	-0.08	-0.07	SI	
Work variety		0.26	0.24	0.24	0.24	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	-0.11	-0.10	-0.10	-0.10	SI	
Information about the work		SI	SI	SI	SI	SI	SI	SNI	SI	SI	SI	SNI	SI	SI	SI	SI	SI	SI	
Career opportunities		0.17	0.16	0.15	0.15	-0.08	SI	SNI	SI	SNI	SNI	SNI	SNI	-0.08	-0.07	-0.08	-0.08	SI	
Communication		0.08	SI	SI	SI	SI	SI	SNI	SI	-0.08	SI	SNI	SI	SNI	SNI	SNI	SNI	SNI	
Professional expertise		0.30	0.29	0.29	0.29	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	SNI	
Job control ^b																			
Decision latitude			0.11	0.09	0.09		-0.07	SNI	SI		SI	SNI	SI		SI	SI	SI	SI	
Autonomy			SI	SI	SI		SI	SNI	SI		SI	SNI	SI		SI	SI	SI	SI	
Social support ^b																			
Support superior				0.07	0.07		-0.08	SNI	SI		-0.08	SNI	SI		SI	SI	SI	SI	
Support colleagues				SI	SI		-0.07	SNI	SI		-0.07	SNI	SI		-0.07	-0.07	-0.07	SI	
Capacity																			
Gender					SNI			SNI	SNI			SNI	SNI				0.10	0.10	0.12
age					SI			SNI	SNI			SNI	SNI				SI	SI	SI
Early signs																			
Well being at work										-0.13			-0.12				SI	SI	
Emotional exhaustion																			0.19
Tension																			0.31
R ²	0.18	0.40	0.40	0.40	0.40	0.26	0.28	SNI	0.30	0.35	0.36	SNI	0.38	0.16	0.16	0.17	0.17	0.17	0.29

^aNegative correlation with “well being at work”: higher score on work-related scale was associated with less “well being at work”. Positive correlation in the other columns: higher score on the work-related scales was associated with more “tension”, “emotional exhaustion” and “perceived health complaints”

^bPositive correlation with “well being at work”: higher score on work-related scale was associated with more “well being at work”. Positive correlation in the other columns: higher score on the work-related scales was associated with less “tension”, “emotional exhaustion” and “perceived health complaints”

than men. In NSP, more advanced age was associated with more “perceived health complaints”. The only negative aspect with a significant correlation was unpleasant treatment/discrimination; this was slightly stronger in NSP than in SP. The positive aspects employment terms, work variety and career opportunities played a significant role. In the scales under job control and social support, there was a significant correlation only for support from colleagues. The majority of these correlations were no longer significant after we had added “tension” and “emotional exhaustion” to the model.

Variance was chiefly explained by the negative aspects of the work, personal factors, “tension” and “emotional exhaustion”.

In step 1, the percentages of explained variance in NSP and SP were 10% and 13%, respectively. These rates were, respectively, 17% and 17% in step 5 and

33% and 29% in step 7. The personal factors in NSP made a much larger contribution to the explained variance than in SP.

Discussion and conclusions

In this study we investigated which factors contributed to the explanation for health effects. In general, “well being at work” could be explained by the positive aspects of work, especially professional expertise and work variety. “Tension” could be explained by the negative aspects. Similarly, the negative aspects were the most important factors behind “emotional exhaustion”; especially, work pressure played a strong role. In the case of “perceived health complaints”, not only the negative aspects, but also age, “tension” and “emotional exhaustion”, made a large contribution to the explained

variance. In literature it is reported that high work demands, low job control and low social support are the most important risk factors (Karasek 1979; Johnson and Hall 1988; Kompier and Marcelissen 1990; De Jonge and Furda 1995; Kompier and Houtman 1995; De Jonge et al. 1996; Van der Doef 2000; Houtman et al. 2000). However, this study showed that in particular high work demands had a strong influence. There were no obvious indications in the present population that improvement in job control and/or social support would have contributed to a decrease of the negative health effects.

Differences between SP and NSP

We investigated where differences occurred between SP and NSP. In view of the large number of respondents, many of the differences found were statistically significant (Table 2), but not all were relevant (Sonke and Rovers 2000). The most important differences were found for professional expertise, "well being at work", autonomy, work variety and career opportunities. In all cases, SP had more favourable scores than NSP.

Linear regression analyses showed only a few differences between NSP and SP. In NSP, the explained variance of "well being at work" by the positive aspects of the work was considerably higher than in SP. Moreover, the association with job control was higher in NSP than in SP.

Social support from superiors and colleagues in NSP contributed to the explanation of "tension" and "emotional exhaustion", but not in SP. However, there was no difference in reported social support between the two populations (Table 2). Even when the items within a scale were evaluated separately, no appreciable differences were ascertained. The existence of an association with social support in NSP perhaps indicates that the need for, and experience of, social support in NSP were different from that in SP. It is possible that the most relevant aspects of social support for SP were not mapped sufficiently by the questions we asked, because they were derived from the questionnaire "Organisation Stress" (VOS-D) (Bergers et al. 1986), which was developed for people with jobs at a lower educational level.

In the first phase of the analysis on SP, each dependent variable was significantly correlated with autonomy (Table 4). In NSP this was only valid for "well being at work" (Table 3). It was striking that in the second phase no significant correlations were found. The same scale was applied in a study on nurses and auxiliaries, where it produced a mean score of 2.81 (SD 0.61) (De Jonge et al. 1995). In comparison, the level of autonomy within the university was extremely high, both in NSP (mean 3.37; SD 0.79) and in SP (3.76; SD 0.63). It is possible that these values were so favourable that autonomy no longer played a role. On the other hand, it is possible that there was an inverse correlation, such as that described in the Vitamin model proposed by Warr (1990). For autonomy, just as for vitamins A and D, it is not always true that

"the more the better"; an increased "dose" can even have negative effects (Warr 1990; Zijlstra et al. 2000). Van Veldhoven et al. (1999) also concluded that high job control is not, per definition, favourable, but that it is more important that the level of control is adapted to the work demands. Table 2 confirms that this is the case: SP not only had higher scores for aspects such as autonomy and decision latitude, but also for "tension". Our analyses showed that in both SP and NSP decision latitude was not correlated with "perceived health complaints". According to Vaas (1995), the influence of decision latitude is chiefly concerned with psychological health. In both populations a correlation was found between "well being at work" and decision latitude. To a lesser extent this applied to SP for "emotional exhaustion" and "tension". These dependent variables lie more closely to physiological health than to "perceived health complaints" (Streiner and Norman 1989).

In this study the number of working hours (e.g. part-time, full-time) did not play any clear role in explaining the health effects. However, the question distinguished only between part-time and not part-time. It was not possible for us to distinguish between a working week of 2 or 4 days, although this may have been important.

The differences between NSP and SP were smaller than we expected. The large number of highly educated persons within NSP might explain this: almost one quarter had a college degree (Table 1). A proportion of the NSP held high positions, with levels of challenge and autonomy similar to those of SP. Further analyses (ANOVA, $P < 0.05$) showed that NSP employees with a college degree were more comparable to SP on aspects such as work variety, work pressure, role ambiguity, decision latitude and perceived health complaints, than the remaining NSP employees. On the scales professional expertise, information, career opportunities and tension, there were more similarities with the remaining NSP employees. Mean values for autonomy and "well being at work" lay between those of the remaining NSP employees and SP. Differences were also found within SP: senior university lecturers and professors had more favourable scores on scales such as work variety, communication and decision latitude, but less favourable scores for work pressure. PhD students had more favourable scores on the scales autonomy and career opportunities. Possibly, the contrast would have been sharper if we had paid closer attention to the diversity within the personnel categories. Another explanation may be that the measurements' technical precision in the high scores was not optimal in the scales we used. There may have been ceiling effects: in the case of high scores the scale did not differentiate sufficiently, or there was too little variance (Streiner and Norman 1989).

Phased occurrence of health effects

In this study we assumed that health effects occurred in phases. To evaluate whether distinctions could be made

between health effects, we calculated the percentage of variance: for “well being at work” it was higher than for “perceived health complaints”. “Emotional exhaustion” and “tension” lay in between. Van der Doef (2000) reported similar findings. In her study the highest explained variance was found for “job dissatisfaction”, while the lowest was found for (psycho)somatic complaints. In our study the percentages of explained variance in NSP and SP were 33% and 29%, respectively. These rates were fairly high, especially when we consider that these types of complaint can be explained not only by work-related factors, but also by factors outside work. The percentages can be expected to increase even further if factors outside work are also included as independent variables.

Personal factors

Sex showed a significant correlation only with “perceived health complaints”: women reported more complaints than men. Differences in health complaints between men and women cannot simply be explained by biological factors (Kolk et al. 1999). Frequently, they concern “vague” physical complaints, in which physiological, social, cognitive and emotional factors play a role. Women distinguish themselves from men on the grounds of more physical sensations and complaints owing to the hormonal cycle, pregnancy and menopause (Kolk et al. 1999; Kolk and Gijsbers van Wijk 1997; Gijsbers van Wijk and Kolk, 1997). However, these differences form insufficient explanation. With respect to the social position, persons who fulfil multiple roles (e.g. work and family responsibilities) consequently receive more external stimuli. In general, these persons pay less attention to physical signs, report fewer complaints and feel healthier than persons with a single role (Gijsbers van Wijk et al. 1991; Kolk and Gijsbers van Wijk 1997; Gijsbers van Wijk and Kolk 1997). However, working women often have part-time jobs and less demanding work. Consequently, they receive fewer external stimuli than persons with full-time jobs and/or persons whose work is more varied and challenging. Thus, they may have more time to take note of vague physical signals (Gijsbers van Wijk et al. 1991; Gijsbers van Wijk and Kolk 1997; Kolk and Gijsbers van Wijk 1997). On the other hand, working women suffer from more complaints that result from over-burdening than men, owing to the combination of outside employment and the taking care of a family (a second reason to incorporate burdens outside work into further research) (Kolk et al. 1995; Kolk and Gijsbers van Wijk 1997). Furthermore, women are more strongly orientated towards internal, physical, sensations and are more likely to attribute them to illness. Explanations for this can be found in the upbringing (boys are taught to ignore physical sensations) and in the role in the family: women often pay attention to symptoms in their children and partner, which gives them greater awareness and knowledge of (ill) health (Kolk and Gijsbers van Wijk

1997; Gijsbers van Wijk and Kolk 1997; Gijsbers van Wijk et al. 1991).

Age played a role only in NSP: older employees in the NSP group reported more “tension” and more “perceived health complaints”. A possible explanation for the lack of other associations between age and, for instance, well being at work is that every age group has some specific work characteristics, which leads to a masking of effects (Griffiths 2000). Younger workers’ concerns about their work appear more immediate and focused on task content. Older workers may experience problems with contextual issues, e.g. lack of recognition, devaluing behaviours of supervisors and colleagues, and disappointment with management (Griffiths 2000).

Methodology

Work-related factors, personal factors and health effects were assessed by means of a questionnaire. We used existing validated scales as much as possible to construct our questionnaire. The internal consistency of the scales used in the development of our questionnaire was generally moderate to good (De Jonge et al. 1995). In addition, we tried to take into consideration the type of work carried out at a university. Van der Doef (2000) is one of the authors who described the necessity of the use of job-specific measuring instruments to obtain the most adequate possible overview of the work situation. Until now, this has received relatively little attention. This may be due to the time investment required to develop many good questionnaires, or because it is difficult for studies on different professions to be compared when job-specific questionnaires have been used.

The response rate of 54% is satisfactory, and we do not expect major effects of selection bias. Representativeness is especially important in descriptive studies. However, in analytical studies like ours it is the variation of exposure that matters for the finding of proper associations (Kristensen 1995). Comparison of the personal characteristics sex and age of the respondents with the personnel database showed that more women and fewer employees younger than 25 years had returned the questionnaire. This can partly be explained by the assumed low response among student-assistants. These employees hold such small jobs that they probably considered themselves as not representative to participate in the study. In addition, we attempted to assess the issue of selective non-response according to job description, but in the personnel database a classification had been used that was not comparable with the manner in which job description was addressed in the questionnaire.

A limitation of this study was the cross-sectional design. It was assumed that work-related factors led to health effects, but as they were measured simultaneously it was not possible for us to draw conclusions about causality or the direction of the correlations found. An illustration of this was the positive correlation between

“work pressure” and “well being at work”: it is probable that close involvement and challenges in the work (aspects of “well being at work”) led to high work pressure instead of the other way around. In addition, it is also possible that tension, emotional exhaustion and perceived health complaints influenced the perception of work-related factors (De Jonge and Furda 1995; De Jonge et al 1996).

Conclusions

From this study it can be concluded that improvement in job control and social support will not always contribute to the prevention of health effects. The negative aspects of work, such as work pressure and role conflict, also require attention. This applies to both non-scientific and scientific personnel. In addition, it can be concluded that it is plausible that health effects occur in phases: in the model, earlier (health) symptoms (“well being at work”) seemed to precede health effects (“perceived health”).

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