Job stress in the nursing profession

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Chapter 4

A Longitudinal Study of Job Stress in the Nursing Profession: Causes and Consequences

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Abstract

This study examines the influence of changes in work conditions on stress outcomes as well as influence of changes in stress outcomes on work conditions. As such, it answers questions still open in literature regarding causality of work environmental characteristics and the health of nurses. A complete, two wave panel design was used with a time interval of three years. The sample consisted of 381 hospital nurses in different functions, working at different wards. Changes in work conditions are predictive of the outcomes, especially of job satisfaction and emotional exhaustion. The strongest predictors of job satisfaction were social support from supervisor, reward, and control over work. The strongest predictors of emotional exhaustion were work and time pressure and physical demands. Reversed relationships were also found for these outcomes. The results of this study are consistent with transactional models of stress that indicate that stressors and stress outcomes mutually influence each other. To prevent nurses from a negative spiral, it seems of importance to intervene early in the process.

4.1 Background

Job stress in the nursing profession has been studied extensively in the last two decades. Many studies have examined the influence of occupational stressors on the health and well-being of hospital nurses. For example, the influence of the dimensions of Karasek's Job Demand Control Support (JDCS) model on nurses' health and well being has been examined abundantly. Job demands, lack of job control, and lack of social support from supervisors and colleagues are associated with burnout and health problems in this occupational group. Next to the JDCS dimensions, other (less frequently studied) work conditions are associated with the health and well-being of nurses. For example, a good reward system is an important factor in the organization of work that is related to job satisfaction (Demerouti et al. 2000). Another important organizational work condition is the structure of communication flow in the hospital (Decker 1997) (for review articles on the influence of JDCS dimensions as well as on other dimensions, see Irvine et al. 1995; Mc Vicar 2003).

The majority of studies on job stress among nurses have cross-sectional designs. Studies with cross sectional designs have several limitations. Firstly, such studies assume a causal relationship of work environmental characteristics predicting stress outcomes. However, the opposite (stress outcomes predicting the (perception of) the work environment), is also plausible (Zapf et al. 1996). The assumption of causality can not be confirmed, nor falsified with a cross sectional design. The second limitation of cross sectional designs is that conclusions on processes, such as the influence of changes in the work environment on the development of job stress, cannot be drawn. Thirdly, cross sectional studies can not rule out the influence of third variables or background variables on the relationship between work conditions and outcomes for example, through mood variables or personality traits such as negative affectivity (Zapf et al. 1996). A longitudinal study in which independent and dependent variables are measured at all times (a complete panel design) can control for these variables. However, existing longitudinal studies on job stress in the nursing profession also have limitations. Firstly, almost all longitudinal studies on job stress among nurses examine the influence of occupational stressors on a stress reaction at a later point in time. Such designs assume that the work environment is static. The work environment is however dynamic and susceptible of changing influences. The influence of changing occupational stressors on stress outcomes has scarcely been examined (van der Doef 2000). Secondly, though earlier studies have suggested that health or stress can influence (the perception of) the work

environment, few studies have actually examined reversed causation (de Lange et al. 2003). The present study attempts to fill in these gaps. We will examine the influence of changes in work conditions on changes in the health and well-being of nurses. Furthermore, reversed causal relationships are tested.

Two studies among nurses that did examine the consequences of changes in demands, control and support, found that a decrease in control and a decrease in support resulted in emotional exhaustion and psychological and somatic complaints, and diminished job satisfaction (de Jonge et al. 1998; van der Doef 2000). Moreover, an increase in demands over time resulted in emotional exhaustion (de Jonge et al. 1998).

As the job demand control support model is considered as an important occupational stress model, most longitudinal studies among nurses focus on these three dimensions in relation to various stress related outcomes. Job demands (such as workload and meeting deadlines, involvement in life and death situations, daily hassles) have been longitudinally associated with emotional exhaustion (Bourbonnais et al. 1999; de Lange et al. 2004;), depression (de Lange et al. 2002; de Lange et al. 2004), health problems (Bradley et al. 2002), and decreased job satisfaction (Davidson et al. 1997; de Jonge et al. 2001). However, other studies among nurses found no relationship between job demands and job satisfaction (Bradley et al. 2002; de Lange 2004; Tyson et al. 2004). It could be that the relation between time demands and work pressure and job satisfaction is in some cases moderated by other factors, such as pay or job commitment or satisfaction of helping others. Job control (participation in decisions, ability to make decisions on the job) has been longitudinally associated with enhanced well-being (Mikkelsen et al. 2000) and job satisfaction (de Lange et al. 2004), and with diminished psychological distress and emotional exhaustion (Bourbonnais et al. 1999; de Lange et al. 2002). Social support (being taken seriously, feeling appreciated, peer cohesion) is beneficial for nurses' well-being and job satisfaction (Mikkelsen, et al. 2000; de Jonge et al. 2001). Through social support, nurses gain better health (Bradley et al. 2002), and their emotional exhaustion and distress diminishes (Firth et al. 1989; de Lange et al. 2004).

Inclusion of other job stressors besides the Job Demand Control Support dimensions improves the prediction of health and well-being (van der Doef 2000). Few longitudinal studies have considered the influence of environmental conditions or organizational conditions on the health and well being of nurses. Organizational conditions can be described as: the way the work is managed and structured (Cooper et al. 1994). Environmental conditions refer to the physical work environment, such as the design of the workplace, tools and equipment. Studies

among nurses reveal that the way in which the work is organized is related to nurses' job stress. For example, associations are found between the amount and quality of personnel, work agreements and planning of work, and the availability and quality material and medical equipment on the one hand, and stress outcomes on the other hand. Furthermore, the importance of financial reward is recognized in studies among nurses (Demerouti et al. 2000; Tyson et al. 2004). Finally, good communication between departments on patient information is beneficial for the job satisfaction of nurses (Davidson et al. 1997). In line with the above described studies, we hypothesize that decreases in job demand and increases in control and support, as well as more favorable conditions with regard to personnel and material resources, rewards, work agreements and communication will result in higher job satisfaction and lower emotional exhaustion and less psychological and physical health problems (hypothesis one).

A review of longitudinal studies in organizational stress research revealed that the problem of reversed relationships is not discussed in many cases (Zapf et al. 1996). Longitudinal studies in general assume normal causal relationships. However, half of the studies that do explore reversed causation find significant associations (Zapf et al. 1996). In some cases, this reversed relationship is even dominant over the normal causal relationship. For example, a longitudinal study among health care workers revealed that increases in emotional exhaustion were related to increases in (perceived) demands, and that this association was dominant over the normal causal relationship (de Jonge et al. 2001). Another study among nurses found the same reversed association, but did not find causal dominance of the reversed relationship over the normal causal relationship (de Lange et al. 2004). We hypothesize that increases in job satisfaction and decreases in emotional exhaustion and psychological and physical health problems will result in less (perceived) job demand and higher (perceived) job control and social support, as well as (a) better (perception of) work conditions with regard to personnel resources, material resources, rewards, work agreements and communication (hypothesis two). Because of unequivocal results of earlier research, we had no prior expectations concerning the dominance of causal or reversed relationships.

4.2 Methods

4.2.1 Design and Participants

We used a complete panel design for this study (see for example Zapf et al. 1996). All independent and dependent variables (see the "measures" section) were measured two times with an interval of three years. This time interval is long enough for changes in work conditions to occur. The research sample consisted of 1267 registered nurses working within an academic hospital in the Netherlands. A total of 807 questionnaires were returned at the first measurement time (Time 1, or T1), which is a response rate of 64%. All 621 nurses still holding their position three years later (at Time 2 or T2) were sent a second questionnaire, of which 381 (61%) responded. The analyses within this article are based on the data of these nurses. Of these respondents, the majority was female (84%). The mean age was 38.8 years (S.D. 8.6; range 20-57 years). About half of the nurses worked 30 hours per week or more. Of the nurses, 60% had job tenures of more than 10 years and 40% had held their present position for at least 5 years. We examined the selectivity of the final sample, by comparing T1 scores for a) nurses that still held their position at T2 versus those that had not held their position at T2, and b) for those nurses that were still employed at T2, we compared responders versus non responders at T2. For the instruments used, see the section measures. The nurses who still worked in their position scored lower on their T1 emotional exhaustion ($t(750) = 3.58$, $p<.001$), psychological distress ($t(748) = 2.65$, $p<.01$) and physical demand ($t(750) = 2.30$, $p<.05$) and higher on decision authority ($t(746) = -2.10$, $p<.05$) than the nurses who had quit their job between T1 and T2. Furthermore the respondents at T2 had a higher T1 job satisfaction than the non-respondents at T2 ($t(745) = -4.28$, $p<.001$). The respondents of T2 did not differ significantly from the non respondents of T2 on the work conditions measured at T1.

4.2.2 Measures

Socio-demographic variables

Data were collected on age, gender, and years of employment.

Quality of work: Work Conditions

The Leiden Quality of Work Life Questionnaire for nurses (LQWLQ-N; Maes et al. 1999) was used to measure the theoretical constructs of the independent variables of the research model. This questionnaire is based on the Leiden Quality of Work Questionnaire (LQWQ; van der Doef et al. 1999) and on the Organizational Risk Factor Questionnaire (ORFQ; Akerboom 1999). The items of the LQWLQ-N are occupation specific. All items are formulated as statements that had to be rated on a 4 point rating scale, ranging from totally disagree to totally agree. The scales are defined below and for each scale the cronbach's alpha is given at T1 and T2, as well as the number of items and an item-example.

Work and Time Demands
(α=.77/.81, 6 items): workload, and time pressure (I must care for too many patients at once).

Physical Demands
(α=.70/.83, 5 items): physical burden of work (At work I must sit in the same position for long periods of time).

Skill Discretion
(α=.70/.80, 6 items): task variety and the extent to which the job challenges one's skills (My job gives me opportunities for self-development).

Decision Authority
(α=.70/.73, 7 items): freedom of decision-making over one's work (I can decide for myself when I engage in patient-related versus non-patient-related tasks).

Social Support Supervisor
(α=.92/.94, 7 items): support provided by the supervisor (I feel appreciated by my supervisor).

Social Support Colleagues
(α=.80/.87, 7 items): instrumental and emotional support provided by colleagues (The nurses in my department work well together).

Nurse-Doctor Collaboration
(α=.77/.74, 5 items): interaction with doctors (In my department, the nurses and doctors work well together).

Personnel Resources
(α=.73/.78, 4 items): amount and quality of personnel on a particular ward (In my department, there are enough nurses to provide good care).

Material Resources
(α=.77/.78, 4 items): availability, amount and quality of materials and instruments on a particular ward (Materials and instruments are not always available when necessary).

Rewards
(α=.80/.82, 6 items): rewards in terms of salary, bonuses or appreciation (In this organization, there are sufficient funds and / or facilities for nurses).

Work Agreements
(α=.80/.87, 7 items): quality and feasibility of procedures (In my department, regulations and procedures are often insufficiently defined).

Communication
(α=.70/.75, 6 items): communication between departments, information provision (In this organization, there is effective interdepartmental communication about patients).

Outcome measures

Job Satisfaction
Job satisfaction was assessed with the LQWLQ-N Job Satisfaction scale (6 items; e.g. "If I had to choose now, I would take this job again", "I am satisfied with my job", α= .82/.86). Statements were rated on a 4 point rating scale, ranging from totally disagree to totally agree.

Emotional Exhaustion
Emotional exhaustion appears to be the major aspect of occupational burnout among human service professionals, including nurses (Buunk et al. 1994). The validated Dutch client version of the Maslach Burnout Inventory (MBI-NL, Schaufeli et al. 1994) was used to assess emotional exhaustion. The scale consists of eight items; (e.g. "At the end of a work day, I feel empty"). Items were scored on a seven-point rating scale, ranging from "never" to "every day / always".

Psychological Distress and Somatic Complaints
Psychological distress and somatic complaints were assessed by means of three subscales of a validated Dutch version of the SCL-90, a 90-item inventory developed by Derogatis (1983). This inventory measures the presence of physical and psychological complaints, scored on a five point rating scale ranging from "not at all" to "very much". The Dutch version of the SCL-90 has been found to have adequate internal consistency, reliability and validity (Arrindel et al.

1986). Two subscales were used to measure psychological distress: anxiety (10 items, e.g. "feeling afraid") and depression (16 items, e.g. "feeling lethargic"). A mean score of the two scales was calculated, because of the high correlation between the two scales (r=.77). Somatic complaints were measured using a subscale of the SCL-90 (12 items, e.g. "pain in chest and heart region").

4.2.3 Data Collection

The questionnaires were sent to the home address of the nurses. Participation in the study was on a voluntary basis. To guarantee confidentiality, an identification code was used on the questionnaires. Only the researchers had access to the key. An answering envelope could be used to return the questionnaire without costs.

4.2.4 Data analyses

In the hierarchical regression analyses, we corrected for the T1 scores of both the independent and the dependent variables. In this way, we controlled for regression towards the mean, ceiling- and floor effects, which are the most important artifacts of change-score analyses (Finkel 1995; Campbell et al. 1999; Taris 2000). A series of regression analyses was performed to test hypothesis one concerning the causal effects of changes in work environment on job stress outcomes. The variables were entered in several steps: in step 1, and step 2, the corresponding T1 outcome and T1 work conditions were entered. In step 3, the changes in the work conditions were entered (T2-T1) into the equation. This set of analysis was repeated for each outcome variable. The reversed relationships (hypothesis 2) were tested with hierarchical regression analyses in which we controlled for the corresponding T1 work condition and T1 outcomes. We performed separate regression analyses for each outcome, because the change scores of the outcomes were highly correlated (Pearson's r of .26 to .52).

4.3 Results

Analysis of the change scores revealed that nurses experience considerable changes in all job conditions and outcomes over time. Depending on the job condition,

24% to 33% of the nurses showed an improvement in the score on the job conditions of more than .5 SD difference between T1 and T2, and 24% to 35% of the nurses showed a worsening in the score on the job conditions of more than .5 SD difference. The variability of the outcomes is somewhat lower: depending on the outcome measure, 12% to 33% of the nurses showed substantial improvements in the health and well-being outcomes (more than .5 SD difference between the T1 and T2 scores), and 18% to 23% showed a change for the worse in the outcomes. The correlations between the changes in job conditions and the changes in outcomes on the one hand and the T2 scores on the job conditions and the outcomes on the other hand, are presented in table 1. At the left half below the diagonal, correlations between changes in work conditions and the outcomes at T2 (normal causation) are presented. At the right half above the diagonal, correlations between changes in outcomes and work conditions at T2 (reversed causation) can be found. The diagonal presents the correlations between the change scores and T2 scores for each variable. The pattern of correlations between change scores and T2 scores (table 1) suggests that there are indications for normal as well as reversed relationships between work conditions and outcomes. More specifically, significant correlations are found between changes in work conditions and T2 job satisfaction and emotional exhaustion, as well as significant correlations between changes in job satisfaction and emotional exhaustion and T2 work conditions. The results concerning our first hypothesis are summarized in table 2. The corresponding outcome, entered in the first step of the regression analysis, explains 23 to 29% of the variance of the outcome at T2. The job conditions at T1 do not predict significant proportions of the variance in the outcomes at T2, though there are two significant betas: material resources at T1 predict job satisfaction at T2, and physical demands at T1 predict emotional exhaustion at T2. Changes in job conditions predict 8%, 11%, 16% and 35% of variance of respectively somatic complaints, psychological distress, emotional exhaustion and job satisfaction. More specifically, increases in skill discretion, decision authority, social support supervisor, reward, and communication, are associated with an increase in job satisfaction over time. Increases in work and time pressure and physical demand, result in more emotional exhaustion over time. Decreases in decision authority are associated with increases in psychological distress. And finally, an increase in physical demand over time is associated with an increase in somatic complaints. Regarding our second hypothesis, our results show that the job conditions at T1 explain 6% to 39% of the variance in the corresponding job condition at T2 (table 3). The proportions of explained variance at T2 show some variation. In general the job conditions are more subject to changes over time than the out-

Table 1 Correlation Coefficients for Study Variables[1][2]

Change score	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T2 score																
1. Personnel Resources	.56**	.13	.19**	.31**	.19**	-.35**	-.17**	.14*	.26**	.24**	.06	.19**	.30**	-.15*	-.08	-.11
2. Material Resources	.15*	.47**	.13	.14*	.21**	-.09	-.22**	.04	.03	.00	.06	.08	.14	-.12	-.01	-.08
3. Reward	.06	.05	.53**	.07	.17**	-.04	-.10	-.06	.00	.04	-.06	.05	.21**	-.09	-.11	-.12
4. Work Agreements	.17**	.10	.05	.65**	.13	-.11	-.18**	.21**	.25**	.30**	.30**	.11	.27**	-.14*	-.03	-.05
5. Communication	.12	.16*	.15*	.17**	.55**	-.12	-.11	.05	.10	.07	.01	.09	.21**	-.16*	-.08	-.06
6. Work/Time Pressure	-.24**	.01	-.15*	-.26**	-.13	.57**	.15*	-.14*	-.22**	-.21**	-.04	-.17**	-.24**	.18**	.09	.09
7. Physical Demand	-.12	-.19**	-.12	-.11	-.14*	.07	.53**	-.16*	-.14*	-.12	-.05	.03	-.17*	.22**	.07	.21**
8. Skill Discretion	.12	.03	.06	.22**	.02	-.15*	-.15*	.67**	.22**	.26**	.12	.01	.23**	-.11	-.02	.00
9. Decision Authority	.24**	.07	.10	.29**	.09	-.17**	-.12	.21**	.61**	.22**	.17**	.09	.25**	-.19**	-.12	-.10
10. Social Support Supervisor	.14*	.00	.07	.36**	.06	-.15*	-.21**	.19**	.18**	.68**	.29**	-.02	.28**	-.16*	-.08	-.11
11. Social Support Colleagues	.11	.08	.04	.38**	-.04	-.09	-.08	.15*	.12	.30**	.61**	.01	.14*	-.11	.02	-.02
12. Nurse/Doctor Collaboration	.26**	.13	.15*	.17**	.14*	-.10	-.17**	.08	.12	.05	.01	.51**	.22**	-.12	-.03	-.07
13. Job Satisfaction	.21**	.09	.24**	.28**	.22**	-.26**	-.17*	.21**	.25**	.24**	.07	.11	.56**	-.23**	-.17*	-.16*
14. Emotional Exhaustion	-.12	-.05	-.08	-.15*	-.15*	.17**	.08	-.12	-.17**	-.15*	-.09	-.09	-.24**	.46**	.22**	.22**
15. Psychological Distress	-.10	-.06	-.11	-.08	-.15*	.06	.00	-.13	-.18**	-.07	-.01	-.09	-.25**	.30**	.43**	.30**
16. Somatic Complaints	-.14*	-.00	-.08	-.04	-.09	.12	.07	-.14*	-.10	-.03	-.02	-.08	-.18**	.28**	.22**	.48**

[1] *Correlations between changes in work conditions and T2 outcomes (normal causal relationships) can be found at the lower left half of the diagonal, correlations between changes in outcomes and T2 work conditions (reversed causal relationships) can be found at the upper right half of the diagonal. The diagonal presents correlations of change scores with T2 scores of the corresponding work condition and outcome.*

[2] ** p =<.01; ** p =< .001*

Table 2 Summary of Hierarchical Regression Analysis for differences in Organizational and Environmental Conditions and differences in Job Characteristics predicting Outcomes on t2

	Job Satisfaction		Emotional Exhaustion		Psychological Distress		Somatic Complaints	
IV	ΔR^2	β	ΔR^2	β	ΔR^2	B	ΔR^2	B
Gender	.01	.06	.00	.03	.01	.08	.01	.09
Age		.07		-.02		-.02		.04
Outcome t1	.23**	.48**	.29**	.54**	.26**	.51**	.28**	.53**
Work Time Pressuret1	.05	.09	.05	.00	.04	.06	.05	.00
Physical Demands t1		-.03		.16*		.07		.12
Skill Discretion t1		.00		.09		.09		.00
Decision Authority t1		-.04		-.09		-.08		-.11
Support Supervisor t1		.03		.04		.00		.04
Support Colleagues t1		.12		.04		-.05		.04
Nurse-Doctor Collaboration t1		.03		.05		.02		.06
Personnel Resourcest1		.03		.06		.10		.11
Material Resources t1		.17*		.00		-.11		-.04
Reward t1		.02		.00		.00		.12
Work Agreements t1		-.06		-.08		-.02		-.12
Communication t1		.07		-.06		.06		-.04
Δ Work Time Pressure	.35**	-.06	.16**	.31**	.11**	.17	.08**	.17
Δ Physical Demands		-.04		.14*		.04		.16*
Δ Skill Discretion		.18**		.03		.01		-.05
Δ Decision Authority		.19**		-.15		-.22**		-.05
Δ Support Supervisor		.22**		-.10		-.09		.04
Δ Support Colleagues		-.04		-.06		-.04		-.09
Δ Nurse-Doctor Collaboration		.08		-.07		-.09		.00
Δ Personnel Resources		.06		.16		.13		.02
Δ Material Resources		.03		-.01		.09		-.05
Δ Reward		.21**		-.03		-.08		-.04
Δ Work Agreements		.04		.01		.09		.08
Δ Communication		.15**		-.09		-.14		-.07
Full model	Adjusted R^2=.60 F(27,282)= 18.11		Adjusted R^2=.46 F(27,288)= 10.82		Adjusted R^2=.35 F(27,283)= 7.27		Adjusted R^2=.37 F(27,284)= 7.70	

* *p =< .01*
** *p =< .001*

come measures. The outcome measures at T1 predict up to four percent of the job conditions at T2. Changes in outcomes predict up to 17% of the variance of (perceived) changes in the job conditions. An increase in job satisfaction over time is related to changes in (ratings of) all occupational stressors. A change in emotional exhaustion also predicts changes in (ratings of) all occupational stressors, though the betas are all smaller than those for job satisfaction. Nurses that develop more somatic complaints over time, also experience more work and time pressure, higher physical demands, and less decision authority, less personnel resources and less reward over time. Finally, an increase in psychological distress over time is related to more (experienced) work and time pressure, less decision authority, and with poorer evaluation of quality of work agreements and procedures, and less well rated communication. We performed separate regression analyses for each work condition predicting each outcome, to be able to make a comparison between the proportions of explained variance and beta's of the normal causal relationships and the reversed causal relationships. The results are summarized in tables 4a (comparison of R^2) and table 4b (comparison of betas). The results show different patterns for job satisfaction and emotional exhaustion on the one hand and psychological distress and somatic complaints on the other hand. For psychological distress and somatic complaints, the work conditions explain more variance in the outcomes than vice versa. Similarly, all betas are higher in case of the normal causal relationships compared to the reversed causal relationships. For job satisfaction and emotional exhaustion, there is no clear dominance of normal or reverse causality.

4.4 Discussion

The present study extends previous research on occupational stress by simultaneous examination of normal causal relationships (the influence of job conditions on health and wellbeing outcomes) and reversed causal relationships (the influence of health and wellbeing outcomes on job conditions). Furthermore, where most longitudinal studies focus on the influence of static work conditions on health and well-being at later point in time, the present study examines the influence of changes in job conditions on changes in health and well-being (and vice versa). Generally, the results indicate that changes in work conditions and changes in health and well being mutually influence each other.

The results partly confirm our first hypothesis: Changes in work conditions are related to changes in health and well-being of nurses. Changes in work con-

Table 3 Summary of Hierarchical Regression Analysis for differences in Outcomes predicting Organizational and Environmental Conditions t2 and Job Characteristics t2. Separate regression analyses for each outcome

	WTP		PhD		SD		DA	
IV	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Gender	.00	.07	.03	-.05	.01	-.06	.01	-.03
Age		-.03		-.16*		-.11		.06
Outcome t1	.11**	.33**	.39**	.63**	.07**	.26**	.06**	.40**
Job Satisfaction t1	.02	-.13**	.00	.00	.03**	.20**	.02	.14
Em Exhaustion t1	.02*	.15*	.00	-.07	.00	-.06	.02*	-.13*
Som Complaints t1	.01	.10	.00	-.07	.04**	-.22**	.01	-.08
Psych Distress t1	.00	.05	.00	-.05	.04**	-.20**	.01	-.10
ΔJob Satisfaction	.13**	-.40**	.05**	-.26**	.15**	.43**	.17**	.46**
ΔEm Exhaustion	.12**	.39**	.04**	.23**	.04**	-.21**	.09**	-.34**
ΔSom Complaints	.03**	.19**	.03**	.18**	.01	-.11	.03**	-.18**
ΔPsych Distress	.02*	.16*	.00	.06	.02	-.14	.05**	-.25**

	SSS		SSCO		NDC		PR	
IV	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Gender	.01	-.06	.02	-.02	.01	.11	.00	.02
Age		-.11		-.15*		-.02		.01
Outcome t1	.09**	.29**	.18**	.43**	.13**	.36**	.07**	.26**
Job Satisfaction t1	.02*	.15*	.00	.02	.00	.03	.01	.10
Em Exhaustion t1	.01	-.07	.00	.00	.00	-.04	.00	-.04
Som Complaints t1	.00	.02	.00	.00	.00	-.02	.00	.03
Psych Distress t1	.01	-.07	.00	-.06	.00	-.01	.00	-.01
ΔJob Satisfaction	.18**	.48**	.04**	.24**	.09**	.34**	.17**	.46**
ΔEm Exhaustion	.06**	-.28**	.03**	-.19**	.03**	-.20**	.05**	-.26**
ΔSom Complaints	.01	-.12	.00	-.06	.01	-.11	.02*	-.17*
ΔPsych Distress	.01	-.13	.00	-.05	.00	-.07	.01	-.11

	MR		R		WA		CO	
IV	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Gender	.04*	.06	.02	.11	.00	.02	.01	.10
Age		.19**		.10		.00		.07
Outcome t1	.17**	.41**	.23**	.49**	.13**	.36**	.25**	.50**
Job Satisfaction t1	.02**	.16**	.01	.12	.02*	.14*	.01	.13
Em Exhaustion t1	.00	-.03	.01	-.07	.02*	-.14*	.00	-.07
SomComplaints t1	.00	-.03	.00	.06	.01	-.08	.00	-.05
Psych Distress t1	.00	.02	.00	.00	.01	-.12	.00	-.02
ΔJob Satisfaction	.05**	.25**	.11**	.29**	.15**	.44**	.12**	.39**
ΔEm Exhaustion	.03**	-.19**	.02**	-.17**	.06**	-.28**	.04**	-.21**
ΔSom Complaints	.01	-.12	.02*	-.15*	.01	-.09	.01	-.12
ΔPsych Distress	.00	.00	.01	-.13	.02*	-.15*	.02**	-.17**

* $p =< .01$
** $p =< .001$

Table 4a R^2 for each pair of regression analyses. Left: normal causal regression. Right: reverse causal regression

	Job Satisfaction		Emotional Exhaustion		Psychological Distress		Somatic Complaints	
	Normal R^2	Reverse R^2	Normal R^2	Reverse R^2	Normal R^2	Reverse R^2	Normal R^2	Reverse R^2
Personnel Resources	.13**	.17**	.04**	.05**	.02**	.01	.02**	.02**
Material Resources	.04**	.05**	.03**	.03**	.00	.00	.02*	.01
Reward	.12**	.11**	.02**	.02**	.03**	.01	.02**	.02**
Work Agreements	.12**	.15**	.05**	.06**	.02**	.02**	.01	.01
Communication	.11**	.12**	.04**	.04**	.03**	.02**	.02*	.01
Work/ Time Pressure	.11**	.13**	.10**	.12**	.04**	.02**	.03**	.03**
Physical Demand	.07**	.05**	.06**	.04**	.01*	.00	.04**	.03**
Skill Discretion	.12**	.15**	.03**	.04**	.02*	.02	.02**	.01
Decision Authority	.15**	.17**	.07**	.09**	.05**	.05**	.03**	.03**
Support Supervisor	.15**	.18**	.05**	.06**	.02*	.01	.01*	.01
Support Colleagues	.04**	.04**	.02**	.03**	.01	.00	.01	.00
Nurse-Doctor Collab	.08**	.09**	.02**	.03**	.02**	.00	.01*	.01

* *p =< .01*
** *p =< .001*

Table 4b Beta's for each pair of regression analyses. Left: normal causal regression. Right: reverse causal regression

	Job Satisfaction		Emotional Exhaustion		Psychological Distress		Somatic Complaints	
	Normal β	Reverse β	Normal β	Reverse β	Normal β	Reverse β	Normal β	Reverse β
Personnel Resources	.48**	.46**	-.27**	-.26**	-.20**	-.11	-.20**	-.17**
Material Resources	.27**	.25**	-.23**	-.19**	-.06	.00	-.17*	-.12
Reward	.39**	.29**	-.17**	-.17**	-.18**	-.13	-.16**	-.15**
Work Agreements	.40**	.44**	-.26**	-.28**	-.16**	-.15**	-.12	-.09
Communication	.38**	.39**	-.23**	-.21**	-.19**	-.17**	-.14*	-.12
Work/ Time Pressure	-.41**	-.40**	.39**	.39**	.25**	.16**	.21**	.19**
Physical Demand	-.27**	-.26**	.26**	.23**	.10*	.06	.22**	.18**
Skill Discretion	.42**	.43**	-.20**	-.21**	-.15*	-.14	-.18**	-.11
Decision Authority	.44**	.46**	-.30**	-.34**	-.26**	-.25**	-.19**	-.18**
Support Supervisor	.45**	.48**	-.27**	-.28**	-.16*	-.13	-.14*	-.12
Support Colleagues	.22**	.24**	-.17**	-.19**	-.09	-.05	-.11	-.06
Nurse-Doctor Collab	.35**	.34**	-.19**	-.20**	-.19**	-.07	-.15*	-.11

* *p =< .01*
** *p =< .001*

ditions are most strongly related to changes in job satisfaction and emotional exhaustion. The influence of changes in work conditions on somatic complaints and psychological distress is much weaker, which is in accordance with other studies that examine multiple stress related outcomes (van der Doef, Maes, & Diekstra, 2000). It seems that somatic complaints and psychological distress outcomes are more influenced by variables outside the work environment. The results of our study suggest that changes in different work conditions are responsible for changes in job satisfaction and changes in emotional exhaustion. Emotional exhaustion is most strongly influenced by increases in job demands, which is in accordance with other longitudinal studies among nurses (Bourbonnais et al. 1999; de Lange et al. 2004). This means that lowering the work pressure or giving nurses more time to be able to provide good care may prevent serious health consequences for nurses. Physical demands could be lowered by good equipment, such as mechanical lifts. The results of our study suggest that nurses' job satisfaction can be increased by giving nurses more control over their job. Increases in support from a supervisor and rewards can also contribute to an increase in job satisfaction. The results of our study furthermore underline the importance of financial reward in relation to job satisfaction, as is found in recent studies among nurses (Demerouti et al. 2000; Mc Vicar 2003; Tyson et al. 2004). Finally, our results suggest that a better communication flow between departments and a good structure of patient information can also increase job satisfaction, which confirms results of cross sectional studies (Davidson et al. 1997). We did not find that changes in demand or personnel resources were related to job satisfaction. The results in studies that examine the relationship between job demands and job satisfaction are inconsistent: some find a relationship (de Jonge et al. 2001), whereas others do not (de Lange et al. 2004). This difference could be due to differences in operalizations of either the concept of job demands or the concept of job satisfaction. The study of de Jonge et al. (2001) used a wide range of qualitative and quantitative demanding aspects, whereas de Lange et al. (2004) only measured work and time pressure, as we did. It could be that more qualitative aspects of job demands (exposure to death and dying or dealing with emotions of patients and relatives) are more related to job satisfaction than the quantitative aspects (time pressure).

The results partly confirm our second hypothesis. Again, a distinction can be made in the results concerning job satisfaction and emotional exhaustion on the one hand and somatic complaints and psychological distress on the other hand. Changes in job satisfaction and in emotional exhaustion have an influence on all job conditions. Changes in somatic complaints and psychological distress

predicted changes in some of the job stressors, and the proportion of explained variance was considerably lower. Similarly, de Lange et al. (2004) found that job satisfaction and emotional exhaustion, but not depression influenced job stressors. Daniels and Guppy (1997) found that only extreme psychological distress lead to higher reported intensity of stressors. Reversed associations between emotional exhaustion and work conditions were found in other studies as well, for example for job demands (Leiter et al. 1996; de Jonge et al. 2001; de Lange et al. 2004), and social support (de Lange et al. 2004). It thus seems that mainly changes in the work related outcomes (job satisfaction and emotional exhaustion) have an influence on the work conditions. Zapf et al. (1996) give two possible explanations for these reverse relationships. Firstly, a change in health and well being can result in a real change in work environment. For example, workers that feel less healthy or less satisfied over time, possibly have less chance of promotion than their healthy and satisfied co-workers. It is also plausible that the pressure and responsibilities are temporarily lowered for someone with physical or mental health problems. Although this seems a plausible explanation, the results do not point in that direction: for example a reduction in job satisfaction and an increase in emotional exhaustion lead to more work pressure. A second possible explanation for reversed causal relationships is that a decrease in satisfaction and the development of physical or psychological complaints has an influence on nurses' perceptions of their work environment and tasks (Zapf et al. 1996). It could be that more exhausted and less healthy workers experience the demands as more heavy, because their resources are already at an end. Or perhaps they simply recall more negative situations. Future research should examine these mechanisms underlying the effect of health on work conditions.

For job satisfaction and emotional exhaustion, the proportion of explained variance and the betas of the normal and reversed associations are comparable. There appears to be no dominance of the normal causal relationship over the reversed causal relationship. For psychological distress and somatic complaints, there is a trend of normal causal relationships being dominant over reversed causal relationships. Other studies have found evidence for dominance of normal causal relationships (de Lange et al. 2004) as well as for dominance of reversed causality (de Jonge et al. 2001). More longitudinal research is needed to examine the relative strength of normal causal relationships and reversed causal relationships for different work conditions and outcomes.

The present study has some limitations that should be noted. A common bias in longitudinal occupational research concerns the healthy worker effect: un-

healthy workers are more likely to have quit their jobs at a second measurement time; hence the healthy workers are overrepresented in the sample of workers that respond both times. The nurses who still worked in their position at T2 experienced less emotional exhaustion and psychological distress at T1 than those who had quit their job. Furthermore, the respondents at T2 had a higher T1 job satisfaction than the non-respondents. It appears that the participants in our study were healthier and more satisfied than the non-participants. This has implications for the generalization of our results. The results of our study apply especially to the more healthy and satisfied subpopulation. A second limitation concerns the design of our study. We used a two-wave panel design with a time interval of three years. The choice of a time interval should be based on how the effect of work conditions on outcomes evolves over time. For example, it is not likely that a change in work conditions will lead to emotional exhaustion in a few months time. Burnout is a chronic stress reaction that usually becomes manifest after exposure to stressors of more than one year (Bakker et al. 2003). We suggest that future studies explore the influence of changes in multiple waves with different time intervals so that the time process underlying the mutual influence of work conditions and different health outcomes becomes clearer.

In conclusion, the results of this study are consistent with transactional models of stress, which indicate that stressors and stress outcomes mutually influence each other. This study confirms the mutual influence of stressors and stress reactions, at least for the stress outcomes of job satisfaction and emotional exhaustion. Future study on the underlying mechanisms is needed.

Because of this mutual influence, the question of cause and consequence becomes more of a discussion on the chicken or the egg. However, the findings do have large consequences in the light of interventions. Because of the mutual influence of nurse's health and environment, it seems of even bigger importance to prevent nurses from a negative spiral where adverse work conditions and reduced health and well being negatively influence each other. For hospital management, it is therefore to intervene early in this process by improving the work environment. The findings of this study can be a point of departure for the focus of such interventions.

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