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Influence of Latent Risk Factors on job satisfaction, job stress and intention to leave in anaesthesia teams: a cross-sectional survey

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Introduction

Current thinking about patient safety emphasizes the causal relationship between working conditions, hereinafter referred to as Latent Risk Factors (LRFs), and the quality of patient care. Breakdown of environmental (i.e., material and equipment), social (i.e., teamwork and communication) or organizational factors (i.e., training and procedures) have been reported to relate to errors that impact performance.[1-3]

Research has shown that LRFs can also adversely affect employee health and well-being.[4-7] A plausible account for such a relationship lies in action regulation theory, postulating that conditions in the environment that tax regulation capacity can lead to regulation problems in attaining task-related goals.[8] The anticipated or experienced threat that task-related goals can not be fulfilled may generate stress, leading to strain, dissatisfaction and/or other negative outcomes.

Most studies on LRFs and worker outcomes focused on the impact of only one or a few factors, for instance either teamwork[9], work procedures[10] or communication.[11] Consequently, little is known about the relative importance of LRFs to employee health and well-being. In addition, research on this topic among anaesthesia teams is scarce, and has focused primarily on anaesthetists.[6;9] Gaining a better understanding of the extent to which LRFs impact on the well-being of anaesthesia staff is worthwhile, because the Operating Theatre is known to be a safety-critical as well as stressful environment.[2;9]

The aim of this study was to examine the relationship of various LRFs to job satisfaction, job stress and intention to leave among anaesthetists, as well as for trainees in anaesthesia and nurse anaesthetists. Considering the differences in work practices, goals, priorities and behaviours

between the different professions of the anaesthesia team, we hypothesized that LRFs are perceived differently by these professions and that the LRFs predictive of the outcome variables vary depending on profession.

Methods

Sample and procedure

The study was approved by the Research Ethics Board (LUMC, Leiden, The Netherlands). Specialist anaesthetists, trainee anaesthetists and nurse anaesthetists from three university hospitals in the Netherlands were approached and invited to participate in the study.

Excluded were participants who had an internship outside their workplace. Postal questionnaires were sent to their work address. A pre-paid response envelope and a letter to explain the purpose of the study and give assurance of confidentiality were enclosed with the questionnaire.

Base-line characteristics

The respondents provided information about the following demographic variables: gender (1 = men, 2 = women), age (in years), working hours (in hours), and years in current hospital (1 < 1 year, 2 = 1 – 5 years, 3 = 6 – 10 years, 4 > 10).

Independent Variables

Latent Risk Factors were measured with the Leiden Operating Theatre and Intensive Care Safety (LOTICS) scale that captures various workplace barriers to safe work practices and safety-critical interpersonal aspects of performance. The LOTICS has been validated with respect to factor structure and reliability of the scales, as well as its content and

discriminative validity.[12] In this study, the following LRFs were measured: Training, Access to Information, Planning & Coordination, Teamwork, Team Instruction, Situational Awareness, Hierarchy, Material Resources, Maintenance, and Procedures (Table 1). Items, presented as statements, were indicators of either potential problems or good practice. Respondents indicated the extent to which they agreed with each statement on a 4-point scale (*1=agree completely, 4=disagree completely)*. The same scale structure was presented throughout the questionnaire, and then adjusted post-hoc.

Table 1: Latent Risk Factors (LRFs), number of scale items, scale's alpha, and example items.

Training (6 items, α=.77)	In my department, people have sufficient knowledge of new medical technological developments
Access to Information (6 items, α=.84)	Information to perform procedure available at the time when it is needed
Planning & Coordination (4 items, α=.75)	Lack of advance planning within the department
Teamwork (4 items, α=.74)	There is an adequate exchange of information during the operative procedure
Team Instruction (4 items, α=.80)	In my department, staff have the necessary professional skills
Situational Awareness (3 items, α=.77)	There is sufficient information exchange during the operative procedure
Hierarchy (5 items, α=.82)	In my department, staff don't always dare to ask for an explanation
Material Resources (6 items, α=.75)	Material/equipment is of insufficient quality
Maintenance (4 items, α=.81)	Maintenance inspections are carried out on time
Procedures (7 items, α=.79)	In my department, procedures, rules, and guidelines are often not feasible in practice

Dependent Variables

There were three dependent variables.

Job satisfaction, indicating positive feelings that workers have regarding their job or facets of their job, which was assessed with the Job Satisfaction scale of the Leiden Quality of Work Questionnaire (3 items, α=.82; e.g., "I am satisfied with my job").[13]

- Job stress, which was measured with a modified version of a stress assessment form.[14] The items tapped into a person's feelings of job-related tension and anxiety (4 items, α=.89; e.g., "I regularly feel too stressed to do my work well").
- Intention to leave, which was measured with two items (α=.72; e.g. "I consider getting another job outside this organisation").

Responses were given on a 4-point rating scale *(1=agree not at all, 4=agree completely)*. Higher scores indicated higher job satisfaction, higher job stress and higher intention to leave.

Statistical analysis

The returned questionnaires were analysed using SPSS® version 17 (Chicago, Illinois, USA). For all LRFs, negatively formulated items were recoded so that a higher score always indicates less favourable perceptions about working conditions. Scale scores were generated by averaging the ratings of all items that were part of the scale. The interne liability of the scales was assessed by calculating Cronbach's alpha. To calculate the percentage frequency of responses to each item, responses on *agree completely* and *agree* have been combined, as have those on *disagree completely* and *disagree*. For all LRF scales the distribution of scores was found normal. One-way analyses of variance (ANOVAs) were used to compare mean scores on LRFs, outcome variables and base-line characteristics (age, time in job, and working hours) across profession.

Post-hoc tests were conducted to examine specific differences between responses to the questionnaire scales. Chi-squared tests were used to compare mean scores across profession for gender. Bivariate correlations were calculated to examine the pattern of direct relationships between base-line characteristics, LRFs and outcome variables. In order to analyse the unique contribution that LRFs made to staff's job satisfaction, job stress, and intention to leave, regression analyses were performed. In each of these analyses base-line characteristics, which significantly correlated with the outcome variable, were included as controls in Step 1.

Results

The study group consisted of 109 specialist anaesthetists, 46 trainees in anaesthesia and 115 nurse anaesthetists. The overall response rate was 62% (270/438). Profession demographics are provided in Table 2. Compared with anaesthetists and nurses, trainees were younger and had the fewest number of years' experience in the hospital. Nurses worked fewer hours than anaesthetists and trainees. There were more female nurses and female trainees than female anaesthetists.

Table 2: Demographics and response rate by profession: Anaesthetists, Trainees in anaesthesia and Nurse Anaesthetists, Mean and SD.

	Anaesthetists N=109	**Trainees N=46**	**Nurses N=115**
	Mean (SD)	Mean (SD)	Mean (SD)
Age	44.8 (9.03) [a]	31.6 (2.96) [ab]	40.2 (10.21) [b]
Time in job	2.8 (.096) [a]	1.9 (0.90) [ab]	2.8 (.085) [ab]
Working hours	42.3 (6.10) [a]	46.3 (2.95) [b]	32.6 (8.37) [ab]
Gender			
Men N(%)	72 (69%) [ab]	23 (52%) [a]	40 (38%) [b]
Woman N(%)	37 (31%) [ab]	21 (48%) [a]	75 (62%) [b]
Response rate	67 %	56 %	72 %

Means that share an identical superscript differ significantly ($p<0.05$) by the Bonferroni procedure.
Note: Time in job 1= < 1 year, 2= 1-5 years, 3= 6-10 years, 4> 10 year;

Perception of job satisfaction and intention to leave differed between professions (Table 3). Post-hoc analyses showed that nurses were less satisfied with their job than anaesthetists and trainees. Trainees had a lower intention to leave their job than anaesthetists and nurses. The difference in job stress between professions was not significant. However there was a significant difference in stress between men and women anaesthetists, mean values respectively 1.64 vs.1.83 (P=.030), with women reporting higher stress levels than men.

Table 3: Mean job satisfaction, stress, intention to leave and Latent Risk Factors scale scores with F values of the ANOVA for each LRF by profession: Anaesthetists, Trainees in anaesthesia and Nurse anaesthesists.

	Anaesthesists	**Trainees**	**Nurses**	
	N=109	N=46	N=115	
Dependent variables	mean	mean	mean	F
Job satisfaction	2.88 [a]	2.97 [b]	2.65 [ab]	6.983 *
Stress	1.77	1.86	1.76	.350
Intention to leave	2.39 [a]	1.92 [ab]	2.35 [b]	7.748 *
Latent Risk Factors				
Training	2.16 [a]	2.23	2.29 [a]	8.61***
Access to Information	2.28 [a]	2.41 [b]	2.65 [ab]	26.14***
Planning & Coordination	2.20 [a]	2.19 [b]	2.38 [ab]	6.78**
Teamwork	1.96[a]	1.86 [b]	2.13 [ab]	8.62***
Team Instruction	2.16 [a]	2.14 [b]	2.38 [ab]	9.74***
Situational Awareness	2.08 [a]	2.22	2.32 [a]	7.69**
Hierarchy	2.16 [a]	2.15 [b]	2.36 [ab]	8.40***
Material Resources	2.02 [a]	2.00 [b]	2.23 [ab]	7.94**
Maintenance	1.81 [a]	1.89	1.99 [a]	6.64**
Procedures	2.22[a]	2.18[b]	2.38 [ab]	5.54**

p <.05; ** p <01; *** p<001.

Table 3 and 4 illustrate the perceptions of Latent Risk Factors for the three groups.

Perceptions of LRFs differed between profession, with nurses reporting more problems on every LRF than anaesthetists and/or trainees. Over 70% of nurses rated Access to information, Training, Planning & coordination and Quality of procedures as poor and perceived the Hierarchy in the operating room as strict. Access to information and Quality of procedures were perceived as poor by more than 60% of anaesthetists and trainees. In addition, over 60% of trainees reported unfavorably on the quality of Training.

Table 4: Percentages of disagreement on Latent Risk Factors by profession Anaesthetists, Trainees in anaesthesia and Nurse anaesthetists

	Anaesthesists	**Trainees**	**Nurses**
	N=109	N=46	N=115
Latent Risk Factors	%	%	%
Training	48	64	73
Access to Information	61	78	90
Planning & Coordination	48	54	74
Teamwork	28	16	40
Team Instruction	42	40	64
Situational Awareness	30	46	46
Hierarchy	56	44	73
Material Resources	39	25	55
Maintenance	17	16	24
Procedures	65	62	72

Correlations

Of the demographic variables, gender correlated significantly to stress for anaesthetists (.26 $P<.005$) and working hours correlated significantly to stress for trainees (.46 $P<.001$).

As can be seen in Table 5, for each of the professions, job satisfaction was moderately to highly correlated with intention to leave. For anaesthetists and nurses, but not for trainees, job stress correlated slightly, but significantly, with job satisfaction and moderately with intention to leave. All significant correlations were in the expected direction.

For anaesthetists there was a moderate to strong relationship between the LRFs and job satisfaction (Table 5). The same pattern of relationships largely holds true for the other two groups. For nurses LRFs were generally moderately correlated with job satisfaction, except Material Resources. For trainees LRFs were generally moderately correlated with job satisfaction, except Access to Information, Team Instruction, Situational Awareness and Material Resources. In comparison with job satisfaction, of the correlations between LRFs and the other outcomes stress and intention to leave, a smaller proportion was significant, with associations ranging from weak to moderate. All significant correlations were in the expected direction.

Table 5: Correlations by profession with job satisfaction, job stress and intention to leave and LRFs

	Anaesthetists			**Trainees in anaesthesia**			**Nurse anaesthesists**		
	job sat	stress	int. to leave	job sat	stress	int. to leave	job sat	stress	int. to leave
Job satisfaction									
Job stress	**-.255***			.012			**-.328****		
Intention to leave	**-.612****	**.469****		**.419***	.069		**-.541****	**.360****	
LRFs									
Training	**-.420****	.031	**.241***	**-.529****	.040	**.455****	**-.459****	**.218***	**.278***
Access to Inform.	**-.464****	-.096	-.151	-.255	.001	.235	**-.434****	.158	**.333****
Planning & Coord.	**-.696****	.094	**.352****	**-.356***	.064	**.509****	**-.308****	.122	.195
Teamwork	**-.611****	**.265***	**.374****	**-.480****	.270	.304	**-.460****	**.219***	**.304****
Team Instruction	**-.502****	.175	.082	-.260	.128	.210	**-.490****	.133	**.225***
Sit. awareness	**-.370****	.072	.213	-.174	-.071	-.093	**-.332****	.134	**.392****
Hierarchy	**-.638****	.096	**.469****	**-.403****	.324	**.533****	**-.406****	**.409****	**.262***
Material Resources	**-.351****	**.261***	.190	-.166	**.391***	.084	-.149	-.014	.089
Maintenance	**-.278****	.130	.095	**-.397****	**.385***	.094	**-.251****	-.013	.054
Procedures	**-.397****	**.301****	**.277***	**-.337****	.223	.290	**-.355****	**.259***	**.345****

* p <.05; ** p <.01 (2-tailed), bold is statistically significant

Regression

The results of the regression analyses are presented in Table 6. Inspection of this table reveals that, generally, the LRFs account for reasonably high percentages of the variances in the outcome variables.

Anaesthetists

The LRFs accounted for a significant proportion of variance in job satisfaction, job stress and intention to leave. The equation shows that job satisfaction was most strongly related to Planning & Coordination and Hierarchy. Gender was a significant correlate of stress and remained statistically significant after controlling for the LRFs, with women reporting higher job stress than men. Procedures, Material Resources and Access to Information were most strongly related to job stress. Hierarchy and Team Instructions were most strongly related to intention to leave. Access to Information and Team Instructions both had a negative beta coefficient (but a positive zero-order correlation), indicating that these variables act to suppress variance in the equation.

Trainees in anaesthesia

The LRFs accounted for a significant proportion of variance in job satisfaction, but not in job stress and intention to leave. The equation shows that job satisfaction was most strongly related to Training, and Maintenance. Working hours was a significant correlate of stress and remained statistically significant after controlling for the LRFs, with trainees working more hours per week reporting lower job stress than trainees working fewer hours per week.

Nurse anaesthetists

The LRFs accounted for a significant proportion of variance in job satisfaction, job stress and intention to leave. Job satisfaction was most strongly related to Maintenance, Access to Information, Teamwork and Hierarchy. Hierarchy was most strongly related to job stress, while Situational Awareness was most strongly related to intention to leave.

Table 6: Multiple regression analyses predicting job satisfaction, job stress and intention to leave from demographics and LRFs for Anaesthetists, Trainees in anaesthesia and Nurse anaesthetists. The table shows the significant β and model R^2.

Anaesthetists	Model	β	R^2
Job satisfaction	Planning & Coordination	-.42***	63
	Hierarchy	-.25*	
Job-related stress	Gender	.32*	33
	Procedure quality	.36*	
	Material resources	.33*	
	Access to Information	-.31*	
Intention to leave	Team instruction	-.40**	41
	Hierarchy	.43**	
Trainees in anaesthesia			
Job satisfaction	Training	-.46 *	56
	Maintenance	-.39 *	
Job-related stress	Working hours	-.47 *	22
Nurse anaesthetists			
Job satisfaction	Teamwork	-.21*	42
	Access to Information	-.23*	
	Hierarchy	-.21*	
	Maintenance	-.25*	
Job-related stress	Hierarchy	.40**	22
Intention to leave	Situational awareness	.29*	26

* p <.05; ** p <01; *** p<001.

Discussion

In the present study, the relationships between Latent Risk Factors (LRFs) and well-being in anaesthesia teams of three university hospitals in the Netherlands were investigated. Generally, the results indicate that the outcomes of interest are predicted rather well by the LRFs. In safety research it has been argued that by controlling LRFs human error can be controlled.[1] Our results suggest that when LRFs are controlled for, they

can also positively influence anaesthesia staff job satisfaction, job stress and intention to leave.

In line with our first hypothesis we found that the different groups of anaesthesia staff have differing perceptions of the LRFs, with nurse anaesthetists reporting more unfavourably on each of the LRFs than the other professionals. Most studies on safety issues in anaesthesia have focused on anaesthetists, but the results of the present study suggest that, in addition to anaesthetists, other anaesthesia team members should be included in studies to get a valid impression of the theatre room's safety health. Despite the difference between the groups in their overall rating of the LRFs, they were rather similar regarding their relative scores on LRFs: all three professions signalled the most problems with the information flow within the hospital and the protocols and guidelines and signalled the least problems with teamwork and the maintenance system.

In line with our second hypothesis we found that the LRFs predictive of the outcomes variables differ between the members of the anaesthesia team. Poor planning & coordination had the most negative effect on anaesthetists' job satisfaction. This result is in line with earlier studies showing that perceived lack of control over work and time planning is one of anaesthetists' major sources of stress.[4;15;16] To increase anaesthetists' job satisfaction probably means finding ways of restoring a sense of control over their own time and planning. High control not only leads to positive outcomes such as job satisfaction, but also acts as an important resource, respectively regulation possibility, for countering the negative consequences of a stressful working life.[17;18] Increased control over the work environment also motivates workers to try out and master new tasks.[19;20]

For anaesthetists poor material resources emerged as an important predictor for higher job stress. Poor material resources place high demands on the performance of staff in high-performance working environments such as the theatre room. One way to facilitate material resources is to minimize the amount of variation in equipment. Higher job stress in anaesthetists was also related to poor procedures. It is important for anaesthetists in stressful situations to be able to rely on best practice.[21 22] However, poor procedures (i.e. not easily accessible, long, complex, rigid, or coming in different versions) make it hard to fulfill required tasks and may even necessitate deviation from the rules to guarantee safe and successful performance. We also found that gender was a predictor for stress in anaesthesists. Women reported more job stress symptoms than men. This result is in line with previous studies. [4;6]

A culture which makes it difficult to speak up, to voice one's opinion or to ask questions if there is something one does not understand was an important predictor of lower levels of job satisfaction in anaesthetists and nurse anaesthesists. Also higher intention to leave in anaesthetists and higher job stress in nurse anaesthetists were related to a strong hierarchy. The willingness to leave the job strongly depended on the presence of conflicts with superiors and co-workers (our hierarchy), low job control (our planning & coordination) and job dissatisfaction. [23] Our findings highlight the importance of the creation of an open and safe environment for interactions, not only for safety purposes as has been shown in previous studies [24], but also for the well-being of the anaesthesia staff.

The importance of 'non-technical' skills for safety, like teamwork and situational awareness, has been well recognized and received more attention on anaesthesia in recent years.[11;25] We found that the importance of 'non-technical' skills for well-being is most evident in nurse anaesthetists. Poor teamwork lowered their job satisfaction while lower levels of situational awareness increased their intention to leave. Active involvement of these members in the progress of the operation helps them to develop knowledge, insight, and experience that enhance their understanding and control of the situation and their opportunity for learning. Lack of development opportunities can lead to disengagement because it undermines employee motivation and learning.[26] Lower levels of job satisfaction in nurse anaesthetists were also related to poor access of information. Obtaining timely and adequate information from others is crucial for nurse anaesthetists to carry out job demands. When the environment does not provide access to information needed to carry out job demands workers feel powerless. One way to boost nurses' job satisfaction is a clear structure for the transmission of information[27] Poor maintenance emerged as another important predictor of lower job satisfaction in nurse anaesthesists. The perception that the maintenance system is working in a way that material and equipment is being maintained before it fails, and thus the system reduces unexpected failures and increases safety, builds employees' trust in management and their confidence about their abilities to handle their work environment and job tasks.

Hours worked per week turned out to be crucial for trainee's anaesthetists job stress. The fewer hours' trainees reported working per week, the greater the job stress they experienced. One possible explanation for this finding is that working fewer hours compromises clinical exposure. Studies

showed that reduced working hours potentially reduce teaching and supervision for interns.[28] [29] To reduce the stress levels of trainees with fewer working hours, a supportive environment and various stress management strategies may help. An important factor for trainees' job satisfaction actually is receiving training. Trainee anaesthetist felt less satisfied with their job when training opportunities were not fully utilised, e.g., poor clinical supervision, few task specific training activities, and reduced time for specialty training. Training has been shown to increase the ability to solve problems, particularly for inexperienced professionals.[30] Poor maintenance emerged as another important predictor of lower job satisfaction in trainees. This is possibly due to the fact that in a training situation, employees must have confidence in the structure of the environment.

This study has some limitations. A point of concern is that the sample only included anaesthesia staff working in three university hospitals in the Netherlands. The experience of participants in these hospitals may differ from those in other hospitals or indeed in other countries. Future research needs to test the hypotheses across a wider sample, including peripheral hospitals, to see if the present findings can be confirmed.
The sample size is also small, particularly for trainees. Therefore, research studies with much larger size would be required to ensure appropriate generalization of the findings of the study. Although the response rate (62%) is acceptable for a postal survey, future research also needs to aim for a higher response rate.
In this research we included a substantial number of LRFs. However, it is conceivable that in addition to the studied set of LRFs other factors may contribute to the outcomes under investigation, such as staffing [5]

housekeeping [31] and financial rewards [32] Future research may consider incorporating these factors.

Finally, due to the study's cross-sectional design, the analyses cannot provide a definite answer concerning the directions of the relationships. The results of this study are therefore suggestive in nature and are meant to give first indications. Longitudinal research is clearly needed to identify causal links in the relations between LRFs and well-being.

Notwithstanding these limitations, the findings of this study suggest that unfavourable LRFs can act as stressful triggers at the workplace. If anaesthesia staff cannot control such stress this may negatively affect their well-being. The key to a healthy workplace seems to be to control the deficiencies in the structure of the work environment. Therefore, we call for intervention studies to test whether or not improving LRFs does affect job satisfaction, job stress and intention to leave of anaesthesia team members positively.

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