

Original Article

Perceived Working Conditions and Sickness Absence - A Four-year Follow-up in the Food Industry

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Objectives: To analyze the association between changes in perceived physical and psychosocial working conditions and change of sickness absence days in younger and older (< 50 and ≥ 50 years) food industry employees.

Methods: This was a follow up study of 679 employees, who completed working conditions survey questionnaires in 2005 and 2009 and for whom the requisite sickness absence data were available for the years 2004 and 2008.

Results: Sickness absence increased and working conditions improved during follow-up. However, the change of increased sickness absence days were associated with the change of increased poor working postures and the change of deteriorated team spirit and reactivity (especially among < 50 years). No other changes in working conditions were associated with the changes in sickness absence.

Conclusion: Sickness absence is affected by many factors other than working conditions. Nevertheless, according to this study improving team spirit and reactivity and preventing poor working postures are important in decreasing sickness absence.

Key Words: Occupational exposure, Social environment, Sick leave, Food industry, Follow-up studies

Introduction

The incidence of sickness absence is high at workplaces with poor physical working conditions [1,2]. The effect of a heavy physical workload is especially strong in combination with poor psychosocial conditions, such as low job control [3]. Research has also shown that many features of psychosocial working conditions (decision authority, adjustment latitude, job control, job complexity, supervisors' support and unfairness) are related to sickness absence [4-14].

Although much is known about factors associated with sickness absence, little is known about the relationship between changes in sickness absence and changes in working conditions.

Vahtera et al. [15] found that negative changes in the psychosocial work environment increased sickness absence and concluded that favorable changes in job control, job demands and social support at work might reduce the risk of sickness absence. Head et al. [16] reported that adverse changes in the psychosocial work environment predicted the incidence of long (> 7 days) but not short (≤ 7 days) spells of sickness absence; if the decision latitude or work demands increased, then the risk for long spells increased, whereas an increase in social support at work decreased the risk. By contrast, to the best our knowledge, there are no similar studies relating changes in physical working conditions to sickness absence.

The present study was conducted in a food industry com-

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pany. This industry is known for its demanding physical conditions due to the way in which production is organized (assembly-line work, repetitive and monotonous movements, hectic pace of work) and the physiological workload (much standing, bending, carrying or lifting of heavy loads) [17,18]. The work also includes high environmental exposure (heat, cold, draught, humidity, dust, odors).

The impacts of the working conditions depend on age [19]. Work ability also decreases with age [20,21]. There are, however, no studies relating age to the association between changes in working conditions and sickness absence. Nevertheless, it is known that short spells of absence are more common in young workers, while older ones have more long spells [22-24], and that sickness absence days also commonly increase with age [25].

The main aim of the present study was to investigate whether changes in perceived physical and psychosocial working conditions over a period of four years are associated with changes in sickness absence and whether these associations differ by age.

Materials and Methods

The study was carried out in a Finnish Food Industry Company employing about 2,000 people [26]. Survey questionnaires on physical and psychosocial working conditions, health and work ability were distributed to all employees in February 2005 and again in February 2009. The employees completed the questionnaires during working hours. Responses given in the beginning of the year clearly reflect past experiences (i.e., the conditions during previous year) of the employees rather than their expectations regarding future conditions. Sickness absence data for the years 2004 and 2008 were therefore used in determining whether changes in the working conditions are accompanied by changes in sickness absence.

Measurement of working conditions

The aspects of psychosocial working conditions studied were the incentive system, the task and goal system, incentive and participative leadership, team spirit and reactivity, task value, extrinsic incentives and opportunities to influence one's work [27]. The incentive system was evaluated using five propositional statements (sample item: "Personnel have an opportunity to develop their own work and work environment in this company"), the task and goal system with four propositions (sample item: "This company has clear and logical/realistic goals"), incentive and participative leadership with six propositions (sample item: "My manager pays attention to my sugges-

tions and wishes"), team spirit and reactivity with six propositions (sample item: "My colleagues discuss improvements to the work and/or the work environment"), task value with three propositions (sample item: "My job includes different and varied tasks"), extrinsic incentives with five propositions (sample item: "I get encouraging feedback on my work") and opportunities to exert influence with five propositions (sample item: "The organization allows its employees an opportunity to set their own goals"). Responses to each statement were given on a 5-point Likert scale with 1 = "totally disagree/very probably not" to 5 = "totally agree/very probably". Mean scores on each of the seven sum variables (ranging from 1.00 to 5.00) were used in the analysis of results. The Cronbach's alphas for the variables ranged from 0.71 to 0.89.

Physical working conditions were assessed with questions adopted from the Quality of Work Life Survey by Statistics Finland [28]. There are six single items about environmental exposure (draught, noise, heat, cold, poor indoor climate and poor lightning) and two questions about biomechanical exposure (repetitive movements and poor work postures). A 5-point Likert rating scale with values ranging from 1 = minimal inconvenience to 5 = extreme inconvenience was used for each item.

Measurement of sickness absence

The data on sickness absence (2004 and 2008) were obtained from the personnel register of the company. Sickness absence was measured in days and was related to the "time at risk", which was obtained by subtracting the time absent from work for reasons other than sickness during the year from the duration of the job contract. The measure of "time at risk" is a person-year, which is 1.0 if a person has been at work for a whole year. Accordingly, sickness absence days were the rates per person year adjusted for "time at risk". Employees were included in the study if they had a time at risk of more than six months in both 2004 and 2008.

Study subjects

A total of 1,201 employees responded in 2005 and 1,398 in 2009, and all provided written consent to the linking of the survey data to the sickness absence register. The response rates were 60% and 72%, respectively. However, only 734 individual employees responded to both surveys. This number reduced to 679 after exclusion of those with less than six months time at risk. Data on age, gender and occupational status (blue-collar or white-collar workers) were also obtained from the personnel register.

The sample included 64 % (n = 433) women and 70 % (n = 475) blue-collar employees, and the mean age in 2004 was 41

years (standard deviation 9.7), ranging from 20 to 62 years.

The study was approved by the Ethics Committee of the Pirkanmaa Hospital District.

Statistical analysis

Changes in the working conditions were calculated by subtracting the values of the year 2005 from the values of the year 2009. The change in sickness absence was calculated by subtracting the rate for 2004 from the rate for 2008. The changes were analyzed by linear regression. The multifactor model comprised age, gender, occupational status, changes in working conditions, changes in sickness absence and baseline level of working conditions and sickness absence, and the variables were introduced by the enter method. The sets of psychosocial factors and physical factors were analyzed separately. Separate analyses were also conducted for younger (< 50 years, $n = 517$) and older (≥ 50 years, $n = 162$) employees with age excluded as an adjusting factor. In addition, analyses with pooled variables of psychosocial factors and physical factors in the same model were conducted for all study subjects and by age group. Adjusted R square values were computed to adjust for the number of explanatory terms in a model. Variables were summarized in the form of means and standard deviations or as medians with ranges. The differences between baseline and follow-up were assessed by paired t-tests or by the Wilcoxon rank sum test. All statistical analyses were performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA).

Results

The data for all employees (Table 1) show that sickness absence increased significantly ($p < 0.001$) from 2004 to 2008. The psychosocial working conditions improved on all indicators. Biomechanical exposure decreased with regard to repetitive and monotonous movements and poor working postures, and decreases in environmental exposure indicators were observed for draught, noise and cold working conditions.

Sickness absence increased from 2004 to 2008 in the younger group (< 50 years) from 6.0 to 8.0 ($p = 0.002$) and in the older group (≥ 50 years) from 6.0 to 12.5 ($p < 0.001$) days per person-year (Table 1). Changes in psychosocial factors did not differ by age group, even though there was a statistically significant improvement in team spirit and reactivity in the younger group, which was not found to be significant in the older respondents. Changes in the physical working conditions were positive or neutral in both groups, with the exception of increased exposure to poor lightning in older employees. Significant improvements were seen in draughty and cold envi-

ronmental conditions and in repetitive and monotonous movements and poor working postures by the younger group and in noise by the older group. Overall, in the older group there were fewer changes in physical factors than in the younger respondents.

Table 2 presents the results of the age, gender, sickness absence days adjusted linear regression models for physical and psychosocial factors separately (Model 1) and pooled (Model 2). Of the physical factors, only the change in poor working postures was associated with the change in sickness absence days: an increase in the change of poor working postures was accompanied with an increase of the change of sickness absence (t -value = 2.92, p -value = 0.004) (Model 1). Among the psychosocial factors, an association was observed between change in sickness absence and change in team spirit and reactivity, but was not statistically significant ($p = 0.084$). Results were parallel with those above, when the multivariate analyses were performed with pooled psychosocial factors and physical factors (Model 2). The association between the change of poor working postures and the change of sickness absence was still statistically significant ($t = 2.18$, $p = 0.029$).

In the age stratified analysis (Table 2), no new associations were revealed. The finding concerning poor working postures survived in both age groups ($t = 2.20$, $p = 0.028$, for younger; and $t = 2.06$, $p = 0.042$, for older employees). The change of decreased team spirit and reactivity was associated with change of increased sickness absence among the younger workers ($t = -2.22$, $p = 0.027$).

In the pooled model (Model 2) the association between the change in poor working postures and the change in sickness absence remains in the age stratified analysis for the younger group ($t = 2.06$, $p = 0.040$), but not for the older group ($t = 0.96$, $p = 0.342$). The association between the change in team spirit and reactivity and the change of sickness absence also remained and was statistically significant ($t = -1.99$, $p = 0.047$) in the younger group in the pooled model. In addition, according to the pooled analysis in the younger employees group, if disturbing exposure of cold changed (decreased), sickness absence ($t = -2.05$, $p = 0.041$) changed (increased).

Discussion

According to this four-year follow-up study among the personnel of a food industry company, negative changes in perceived team spirit and reactivity and in perceived poor working postures were associated with increased sickness absence days. The finding regarding team spirit and reactivity applied only to employees younger than 50 years. In addition among them

Table 1. Distributions of sickness absence days, perceived physical and psychosocial factors in the baseline year and in the follow-up year and their statistical differences among all study subjects and among two age groups

	All (N = 679)													
	< 50 years (n = 517)						≥ 50 years (n = 162)							
	Baseline		Follow-up		p-value*		Baseline		Follow-up		p-value*			
Sickness absence days, median (range)	z-value	t-value	df	p-value	z-value	t-value	df	z-value	t-value	df	z-value	t-value	df	p-value
Physical factors, mean (SD)														
Draught	2.9 (1.30)	2.8 (1.23)	2.8	0.003	2.9 (1.28)	2.8 (1.22)	2.8	2.8 (1.34)	2.8 (1.25)	2.8	2.8 (1.34)	2.8 (1.25)	155	0.301
Noise	3.2 (1.29)	3.1 (1.25)	669	0.006	3.2 (1.28)	3.1 (1.23)	512	3.2 (1.33)	3.0 (1.30)	512	3.2 (1.33)	3.0 (1.30)	156	0.014
Indoor climate	2.7 (1.10)	2.6 (1.13)	661	0.100	2.7 (1.09)	2.7 (1.14)	508	2.6 (1.13)	2.4 (1.10)	508	2.6 (1.13)	2.4 (1.10)	152	0.222
Lightning	2.1 (0.92)	2.1 (1.00)	660	0.263	2.1 (0.92)	2.1 (0.96)	507	2.0 (0.92)	2.1 (1.13)	507	2.0 (0.92)	2.1 (1.13)	152	0.247
Heat	2.1 (1.19)	2.0 (1.11)	662	0.731	2.1 (1.19)	2.1 (1.10)	508	2.0 (1.18)	2.0 (1.13)	508	2.0 (1.18)	2.0 (1.13)	153	0.875
Cold	3.0 (1.28)	2.8 (1.21)	662	< 0.001	3.1 (1.23)	2.8 (1.20)	505	2.9 (1.43)	2.7 (1.26)	505	2.9 (1.43)	2.7 (1.26)	156	0.154
Repetitive and monotonous movements	3.0 (1.27)	2.9 (1.27)	665	0.004	3.1 (1.28)	2.9 (1.29)	509	2.8 (1.21)	2.8 (1.20)	509	2.8 (1.21)	2.8 (1.20)	155	1.000
Poor working postures	2.9 (1.26)	2.8 (1.23)	669	0.028	3.0 (1.28)	2.9 (1.23)	510	2.7 (1.18)	2.7 (1.20)	510	2.7 (1.18)	2.7 (1.20)	158	0.689
Psychosocial factors, mean (SD)														
Incentive system	3.0 (0.67)	3.2 (0.73)	645	< 0.001	2.9 (0.65)	3.2 (0.73)	498	3.0 (0.74)	3.2 (0.72)	498	3.0 (0.74)	3.2 (0.72)	146	< 0.001
Task and goal system	3.5 (0.56)	3.6 (0.63)	653	0.048	3.5 (0.56)	3.7 (0.63)	501	3.6 (0.56)	3.6 (0.64)	501	3.6 (0.56)	3.6 (0.64)	151	0.158
Incentive and participative leadership	3.5 (0.69)	3.7 (0.78)	653	< 0.001	3.5 (0.68)	3.7 (0.76)	497	3.5 (0.73)	3.7 (0.83)	497	3.5 (0.73)	3.7 (0.83)	155	0.002
Team spirit and reactivity	3.4 (0.82)	3.5 (0.72)	661	< 0.001	3.5 (0.65)	3.6 (0.67)	506	3.3 (0.75)	3.4 (0.83)	506	3.3 (0.75)	3.4 (0.83)	154	0.264
Task value	3.4 (0.82)	3.8 (0.80)	668	< 0.001	3.4 (0.81)	3.8 (0.80)	511	3.4 (0.86)	3.8 (0.82)	511	3.4 (0.86)	3.8 (0.82)	156	< 0.001
Extrinsic incentives	2.7 (0.74)	2.9 (0.75)	655	< 0.001	2.7 (0.72)	2.9 (0.72)	498	2.7 (0.79)	2.9 (0.83)	498	2.7 (0.79)	2.9 (0.83)	156	0.003
Opportunities to influence	3.4 (0.71)	4.0 (0.62)	663	< 0.001	3.4 (0.70)	4.0 (0.60)	507	3.4 (0.77)	3.9 (0.68)	507	3.4 (0.77)	3.9 (0.68)	155	< 0.001

SD: standard deviation. *analyzed by paired samples t-test and results shown by t-value with degrees of freedom (df) despite of sickness absence days, which were analyzed by Wilcoxon Rank Sum test. Statistically significant results were shown in bold.

Table 2. Associations of the change of sickness absence days from year 2004 to year 2008 and change of perceived physical and psychosocial working environment from 2005 to 2009

Independent variable	Adjusted by age, gender, occupational status, and baseline-factors All (N = 679)						Adjusted by gender, occupational status, and baseline-factors					
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	t-value	p-value	t-value	p-value	t-value	p-value	t-value	p-value	t-value	p-value	t-value	p-value
Physical factors; change of												
Draught	-0.12	0.908	-0.89	0.372	0.54	0.587	-0.31	0.758	-0.79	0.433	-0.80	0.428
Noise	-0.48	0.630	0.08	0.941	-0.75	0.455	-0.31	0.758	-0.24	0.810	-0.30	0.762
Indoor climate	1.63	0.103	0.53	0.594	1.02	0.308	-0.01	0.994	1.47	0.144	1.06	0.292
Lightning	-0.43	0.667	-1.17	0.244	-1.09	0.275	-1.97	0.050	0.93	0.352	1.33	0.188
Heat	0.66	0.511	0.12	0.908	0.88	0.381	0.77	0.440	-0.14	0.891	-0.96	0.340
Cold	-0.78	0.434	-1.18	0.240	-1.70	0.090	-2.05	0.041	0.68	0.500	0.94	0.350
Repetitive&monotonous movements	-0.68	0.494	-0.16	0.876	0.13	0.901	0.33	0.745	-1.46	0.148	-1.27	0.207
Poor working postures	2.92	0.004	2.18	0.029	2.20	0.028	2.06	0.040	2.06	0.042	0.96	0.342
Physical factors R ²	23.6%				29.2%				22.3%			
Adjusted R ²	21.1%				26.4%				10.2%			
F-value	9.497				10.316				1.843			
p-value	< 0.001				< 0.001				0.025			
Psychosocial factors; change of												
Incentive system	-1.17	0.241	-1.48	0.140	-1.20	0.233	-1.15	0.250	-0.20	0.842	-0.64	0.526
Task and goal system	1.24	0.215	0.77	0.444	1.02	0.311	0.84	0.403	0.46	0.648	0.30	0.769
Incentive and participative leadership	0.47	0.637	1.30	0.194	-0.54	0.588	0.38	0.705	1.49	0.138	1.00	0.320
Team spirit and reactivity	-1.73	0.084	-1.40	0.163	-2.22	0.027	-1.99	0.047	-0.54	0.589	-0.07	0.945
Task value	0.26	0.793	0.75	0.452	-0.29	0.774	0.66	0.511	1.05	0.295	0.86	0.392
Extrinsic incentives	0.03	0.979	-0.19	0.852	1.10	0.271	0.05	0.963	-1.09	0.279	-0.38	0.706
Opportunities to influence	-0.51	0.607	-0.68	0.495	0.02	0.984	-0.85	0.395	-1.16	0.247	-0.28	0.780
Psychosocial factors R ²	23.7%				29.2%				21.9%			
Adjusted R ²	21.3%				26.4%				10.4%			
F-value	9.720				10.477				1.902			
p-value	< 0.001				< 0.001				0.024			
Pooled (model 2) R ²			5.8%				8.5%				20.4%	
Adjusted R ²			-0.1%				1.2%				-8.5%	
Pooled F-value			0.977				1.167				0.705	
Pooled p-value			0.506				0.248				0.867	

Baseline-factors: physical and psychosocial factors in the year 2005 and sickness absence days in the year 2004, Model 1; physical and psychosocial factors in separate models, Model 2; physical and psychosocial factors pooled into the same model, R²: the coefficient of determination. Linear regression models with enter method were used (N = 679). Psychosocial and physical factors are presented separately in the model. Statistically significant results are shown in bold.

positive change, decrease of perceived cold, seemed to be significant for an increase in sickness absence.

However, changes in most of the studied features of physical and psychosocial working conditions were not associated with changes in sickness absence.

Differences by age in the associations between changes of working conditions and sickness absence were rare. This was contrary to our assumption that associations would be found among the older employees in particular, as in an earlier 11-year follow-up study, where municipal workers over 50 were susceptible to work disability [29]. The lack of associations with age in our study could partly be explained by a 'healthy worker effect' due to only those with enough good work ability remaining in the physically demanding food industry jobs.

In sum, only three out of fifteen indicators of working conditions were associated with the change in sickness absence. Moreover, the indicators showing the greatest change (task value and opportunities to exert influence) were unrelated to changes in absence days. Sickness absence is not likely to be strongly associated with features of the working conditions or the work community. The psychosocial environment outside work may also have effects on sickness absence [14]: for example, sickness absence seems to depend on a person's close community [30], as well on the local community in which an individual lives [31].

Although conceptually different, the indicators in our study clearly overlap with those used in the study by Vahtera et al. [15], such as job demands and job control. However, we found weaker associations than Vahtera et al. The reason may be that Vahtera's study was conducted in a different setting (public sector), and there were only healthy employees in the cohort. A specific new finding of our study was the association between a negative change in team spirit and reactivity and change with increased sickness absence. With respect to the much discussed quality of leadership, this study did not confirm the association with sickness absence and was therefore not in agreement with the findings of earlier research [32].

Psychosocial working conditions in general have lately dominated discussions about the reasons for sickness absence, in both research and practical work life. However, Laaksonen et al. [33] found that psychosocial working conditions, such as low job control in women and job dissatisfaction in men, were less significant predictors of sickness absence than the physical conditions (heavy workload and environmental exposures). In our study both aspects of working conditions were emphasized equally, but our findings do not permit us to state whether physical or psychosocial factors are more important. Furthermore, in the realm of physical working conditions, our study

supports the conclusion of Allebeck and Mastekaasa [34] that biomechanical factors (e.g., poor working postures) are more important for sickness absence than environmental conditions (e.g., draughts). The finding in our study that cold working conditions are associated with sickness absence among those below 50 years of age is difficult to explain and might be caused by some relationship between physical and psychosocial factors among younger employees.

The strength of this study is the follow-up design and the combination of the sickness absence register and a questionnaire. A research design in which change is related to change has been rare in the field of sickness absence research. In such a design, the most valid indicator of sickness absence is number of days, as it allows the use of more advanced statistics than the number of spells. A limitation inherent in an observational setting is that it is not possible to predict whether - and what kind of - changes occur in the presumed determinants of sickness absence during follow-up. In the beginning and during the study, the researchers did not become aware of any major and purposeful interventions in the working conditions. The changes, which took place, can be characterized as spontaneous, or due to the routine occupational safety and human resource management of the company.

The follow-up time-frames were different for the surveys (2005-2009) and the sickness absence data (2004-2008). This was considered to be the most reliable approach because employees' responses about their work reflect their past experiences and may therefore be more comparable with sickness absence data for the previous year. In the event that the basic assumption is wrong and that the employees' responses should reflect their experiences from the moment they complete the questionnaire and/or the expectations of the future working conditions, the mismatch of the data-set years could be seen as a limitation of the study. A further limitation was that factors outside work life [30] could not be included in the statistical analyses. Finally, the study was restricted to the food industry. While the exploration of sickness absence and working conditions in other industries was not possible within the scope of the present study, future research with the same design should be done in different industrial settings to test the generalization of the current findings.

In general, improvement in the employees' working conditions was paralleled by an increase in sickness absence. Taking this result strictly, we cannot subscribe to the encouraging statement at the end of many study reports that it is possible to lower the level of sickness absence by paying more attention to the psychosocial and physical working conditions. The findings of this study indicate that sickness absence is mostly caused by

reasons other than physical and psychosocial factors. Sickness absence is associated with many other things, both inside and outside working life. Nevertheless, it might be possible to decrease sickness absence by improving team spirit and reactivity in the work community among employees under 50 years old and by decreasing the physical exposure due to poor working postures among employees of all ages.

Since the opportunities to improve working conditions are more or less limited, depending on the work tasks [35], it might be rewarding, instead of conducting nonspecific intervention projects, to pay attention to the factors identified in this study (team spirit and reactivity and working postures) as an integral part of the schedule to promote employees' work ability and prevent sickness absence [35].

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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