

The Psychosocial Work Environment and Skin Symptoms among Visual Display Terminal Workers: A Case Referent Study

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Background. This study is a part of the interdisciplinary project *The Office Illness Project in Northern Sweden*, which was initiated with a questionnaire study in late 1988. Previously published results from the project have shown that facial skin symptoms reported among visual display terminal (VDT) workers are associated with a number of exogenous factors. This part of the project investigated the relation between the psychosocial work environment and facial skin complaints. **Methods.** From an initial questionnaire study among 4943 office workers, 163 VDT workers were selected for a case referent study of facial skin symptoms. The data comprise a self-administered questionnaire filled out by 149 subjects and interviews with representatives of the organizations concerned.

Results. Psychosocial conditions, especially lack of social support from co-workers, were associated with an increased risk of reporting skin symptoms. Stratification by sex showed that the associations between some psychosocial factors and health differed between men and women. The results indicate that there might be an interaction between psychosocial factors and electric fields in the workplace which increases the risk of reporting skin symptoms.

Conclusions. This study supports the idea that the aetiological basis of facial skin symptoms among VDT-workers includes physical as well as psychosocial factors, and that the interaction between such factors might be significant in the understanding of skin complaints among VDT workers.

Keywords: facial skin symptoms, visual display terminal (VDT) work, office workers, psychosocial factors, occupational stress, electromagnetic fields

Facial skin symptoms among VDT (visual display terminal) workers have been reported from Sweden¹⁻³ as well as from other countries; Norway,⁴ Great Britain,⁵ USA⁶ and Japan.⁷ Overall VDT operators report skin symptoms more frequently than office employees not working with VDTs.^{1,8} The most prevalent complaints have been sensory symptoms, erythema and rosacea.^{4-6,9} Individuals with skin symptoms also complain more often of eye discomfort, musculoskeletal symptoms and headaches when compared with others.¹⁰

An exposure-response relationship between amount of daily VDT-work and self-reported symptoms has

been found.^{1,3,8} No specific VDT-related skin disorder has been found in clinical studies^{11,12} and a discrepancy between self-reported symptoms and dermatological findings has also been found.¹³

Different potential causes of these skin complaints have been discussed. Electrical sources have been found to be related to skin symptoms e.g. electrostatic fields in front of the screen,^{4,14,15} (although other studies have refuted this¹⁶⁻¹⁸), alternating electromagnetic fields emitting from VDTs and background electric fields in the workplace.¹⁸ However, provocation studies have thus far not been able to confirm the hypothesis that a certain level of electrical or magnetic field can cause skin symptoms.¹⁹ It has been suggested that VDT workers with skin symptoms suffer from occupational strain, 'techno-stress'.²⁰ It has also been suggested that VDT-related skin symptoms, as well as 'hypersensitivity to electricity', are facets of the '20th Century Disease' or 'Total Allergy Syndrome'.¹³ Recent studies on

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skin complaints also indicate that skin symptoms are of multi-factorial origin.³

Psychosocial factors have been addressed in studies of VDT-related health, although skin symptoms have rarely been the focus.²¹ More thorough attempts to investigate the significance of different parts of the psychosocial work environment are still missing. The concept 'psychosocial work environment' refers to work content or psychological demands of work, organization of work and social relations at the workplace.²² The impact of the psychosocial work environment on health and well-being is well documented.^{23,24} Even if alternative explanations to associations between psychosocial factors and health must be considered,²⁵ extensive research in this area has established that the psychosocial work environment must be taken into account in studies of work-related illness.

HYPOTHESIS

The study focuses on the role of the psychosocial work environment in understanding of facial skin complaints among VDT workers. Our basic hypothesis is that a poor psychosocial work environment may constitute a risk factor, directly as a stressor, which through psychophysiological mechanisms causes symptoms, and/or it may act indirectly by making the individual more susceptible to other risk factors in the work environment.

MATERIAL AND METHODS

This study is a part of the interdisciplinary project *The Office Illness Project in Northern Sweden*, which was initiated with a questionnaire study in late 1988.^{3,26} The screening population (4943 respondents) consisted of 3233 VDT workers. The sex distribution was 52% women and 48% men.

A case was defined as a VDT worker, i.e. an employee having at least one hour of daily VDT work, reporting *itching, stinging, tight or burning sensations in facial skin and facial skin erythema or dry facial skin* every week during the preceding 3 months. Office workers not fulfilling the symptom criteria constituted referents.^{3,26} From a total of 133 cases, 75 were randomly drawn. A number of surplus cases and referents were added to compensate for possible dropouts. Cases and referents were pair matched for three potential confounders, age (± 5 years), sex and geographical area. All individuals spent most of their time at work in one single room.

From 85 matched pairs we obtained data on 163 subjects; 79 cases and 84 referents. Of these, 160 attended a clinical examination, after which they also filled in an

extensive questionnaire addressing psychosocial and organizational factors.²⁷ The return rate on this questionnaire was 93% (149/160); 72% women, 28% men. The median age was 41 years in both sexes. The distribution of a number of clinical characteristics of cases and referents have previously been reported.²⁶ Interviews with representatives of the organizations concerned were performed between January and April 1989. The purpose of the interview was to get information on the respondents' workplace.²⁷ To prevent bias neither the interviewer nor the person interviewed knew whether the employee concerned was classified as a case or as a referent.

To test the strength in different risk factors, odds ratios (OR) were used. Although we had a matched data set, we used an unconditional logistic regression model in the bivariate analyses as well as in the multivariate analysis in order to reduce dropouts. Mixing variables from different sources was associated with a considerable number of missing values for some variables in the analysis. An unmatched analysis uses more information as data on both people in matched pairs are not required. The influence of different factors on the risk of having skin symptoms was calculated in a multivariate analysis (EGRET package²⁸). To test the significance of the OR, 95% confidence intervals [CI] (Miettinen's method) were used.

Construction of Indices

As psychosocial factors are rarely made up of single direct measurable entities, factor analysis was used to identify relevant factors in some parts of the analysis.²⁷

Work demands. Four indices measuring work demand were used. The first, *amount of work*, was based on items measuring amount of work and how often a person is faced with work overload. The second, *role conflict*, was based on items measuring interruptions from co-workers or others during task performance, feelings of 'being pulled in every direction' and perceptions of incompatible demands. All items above were combined into a third, more comprehensive index, *workload*. The fourth index, *skill usage*, was based on items referring to skills and qualifications required to perform work tasks.

Work control. Three indices measuring work control were used. The first, *task authority*, was based on items measuring feelings of being tied to a certain work pace, possibilities of alternative work methods and decision authority in task performance. The second, *control over the work situation*, was based on items referring to possibilities of deciding what tasks to do and influence

at the workplace on the whole. All these items were used in a third index, *work control*.

Social support. Five indices were used. The first index, *support from supervisors*, was based on items referring to how workers got along with supervisors and if they got support from supervisors when needed. The second, *support from co-workers*, included items measuring how workers got along with work mates, if they got support from work mates when needed and if they discussed work with co-workers. The third, *work status*, was based on items measuring supervisors and co-workers appraisal concerning the tasks performed. The fourth index, *feedback*, included items measuring feedback from supervisors and co-workers. The fifth index, *intra-organizational relations*, was based on items referring to relations to other groups at the respondents' department and to other departments at the workplace.

Five composite measures using the indicators discussed above were constructed. *Workload/control*, was based on the model proposed by Karasek²³ and the two indicators *workload* and *work control*, presented above, were used. In the second composite measure, *workload/co-worker support*, the control dimension was replaced by *support from co-workers*. In the third composite measure, *workload/support from supervisors*, demand was combined with *support from supervisors*. By replacing work control with these support dimensions, we were able to address plausible joint effects of workload and support. To examine the combined effects of high workload, low control and low support, two variables were constructed. These were the multiplicative combination of, first, *workload*, *work control* and *support from co-workers*, and second, *workload*, *work control* and *support from supervisors*.

Job satisfaction. Two indices reflecting satisfaction with work were used. *Workplace satisfaction* included items referring to satisfaction with salary and other benefits, opportunities for development and 'growth', and investments in personnel development. *Overall job satisfaction* was intended to reflect satisfaction with work on the whole and included items referring to general feelings about work when leaving home, general satisfaction with the job and thoughts about resigning from the job.

Reorganization. To test if there were any associations between job reorganization and reports of symptoms the index *reorganization* was constructed. This index was based on the interviews that were conducted with representatives of the organizations concerned. Workers in organizations characterized by ongoing or recently

accomplished reorganization; i.e. decentralization and management by objectives were compared with workers in organizations without any changes of this kind going on, or recently completed.

Worry. An index with the purpose of capturing feelings of worry, uneasiness and anxiety was constructed, including items referring to worry concerning illness caused by work, reorganizations, new technology and economic restraints.

Information. The role of information given at the workplace was covered by the index *information*, including items reflecting satisfaction with information concerning changes at the workplace and information about what is happening at the workplace on the whole.

The distribution of each index was divided into three groups and the low index categories were compared with high index categories. The composite measures *workload/control*, *workload/support from supervisors* and *workload/support from co-workers*, were divided into four categories, as discussed by Karasek and Theorell.²¹

Construction of Confounders

Confounders were chosen with the purpose of covering different areas of interest, and they are discussed in other reports from *The Office Illness Project in Northern Sweden*^{18,25}: *atopic dermatitis*, *VDT-related magnetic field (B-ELF)*, *background E fields*, i.e. the mean value of alternating electric fields in the room with the VDT power supply off and *amount of VDT work*, i.e. average daily time with VDT work during the preceding 12 months.

All confounders were associated with a higher risk of having symptoms (high index group compared with low index group): atopic dermatitis (OR = 2.1, 95% CI : 0.8–6.0), electric background field (OR = 3.0, 95% CI : 1.2–7.2), VDT-related magnetic field (OR = 2.7, 95% CI : 1.05–6.7) and amount of VDT work (OR = 1.6, 95% CI : 0.8–3.2). The significance of these confounders have been discussed elsewhere.^{18,26}

RESULTS

The main objective of this study was to investigate the relation between the psychosocial work environment and facial skin symptoms. Psychosocial factors will be discussed even if they are connected with a risk level which was not significant at the 95% level because there is little published information investigating the relation between psychosocial factors and facial skin symptoms.

Bivariate Assessment

Work demands. None of the indicators of work demands used had a significant effect on the risk of having symptoms. Employees reporting *high amount of work* had an increased risk of having symptoms, though it was not significant. However *role conflict*, *workload* (composed of the two former) nor *skill usage* were not connected with any increased risks of having symptoms. When the sample was stratified by sex, low skill usage was connected with an increased risk level for men whereas the reverse was found among women.

Work control. Assessments of the whole sample did not show increased risk levels among individuals reporting low *task authority*, low *control over work* or low *work control* (the composite measure). However, separate analysis for males and females showed that low control over work as well as the composite measure low work control, were associated with higher risk levels among men, although these were insignificant.

Workload/work control. We found an increased risk, but not of significant strength, for skin symptoms in the high-stress category as postulated in the model proposed by Karasek.²³ The highest risk was found in 'active' jobs (OR = 2.7, 95% CI : 1.08–6.9), i.e. jobs characterized by demanding work situations combined with an extensive control; work characteristics that are supposed to imply prerequisites for good health and well-being rather than the opposite. A stratified analysis of men and women showed that the highest risk for men was found in high-stress jobs, as postulated in the model, whereas active jobs were associated with the highest risk among women (OR = 5.8, 95% CI : 1.6–21.5).

Social support. An increased risk of significant strength was found among workers reporting low *feedback* and among those reporting low *support from co-workers*. Stratifying by sex did not change the picture. Low *work status* and adverse *intra-organizational relations* were not connected with any increased risks.

Workload/co-worker support. A significant higher risk of having symptoms was found among those having jobs characterized by a high workload and low support from co-workers.

Workload/support from supervisors. Those with high workload and low support had a significantly higher risk of having symptoms. Comparing the risk level of this composite measure with those of the two indicators included, it indicated that there is a strong interaction between the two variables.

Workload/work control/support from co-workers. Those with high workload, low control and low support from co-workers, had a higher, but not significant, risk of having symptoms, compared with the reference category. No interaction between the indicators was found.

Workload/work control/support from supervisors. The risk level was only slightly higher in the category with high workload, low control and low support from supervisors, compared with the reference category.

Job satisfaction. Neither low *workplace satisfaction* or low *overall job satisfaction* were associated with risks of significant strength. Higher risk levels were found among males compared with females.

Reorganization. Organizational changes, i.e. decentralization and management by objectives, were not associated with any risk of having symptoms. We even found lower risk levels among workers in organizations characterized by ongoing or recently accomplished changes.

Worry. We did not find any increased risk among individuals in the high worry category. Differentiating among the items comprising the index we found that those reporting that they were often worried about being ill as a result of their work had a significantly higher risk (OR = 5.7, 95% CI : 1.2–29.5) of having symptoms compared with those reporting that they never were worried about being ill.

Information. Workers reporting lack of information had an increased risk of having symptoms of borderline significance compared to workers content with the given information.

Thus, the bivariate analyses showed associations of significant strength only between some of the psychosocial indicators used and the risk of having symptoms. Only two of the original variables, *feedback* and *support from co-workers*, showed significant strength. Concerning the composite measure *workload/work control*, the highest risk was found among those having 'active jobs', which is somewhat contradictory to what the original model proposed by Karasek²³ postulates. However, stratifying by sex showed that the risk in active jobs was only true for women, whereas the highest risk level for men was found in high-stress jobs, as postulated in the model. The composite measure *workload/support from supervisors*, showed an interaction between the two included indicators which resulted in a significant effect on the risk of having symptoms. The

TABLE 1 Unmatched analyses of psychosocial factors (risk category compared with reference category) and their effect on the risk of reporting facial skin symptoms

Psychosocial risk factors	Men		Women		Men and women	
	Crude OR	95% CI	Crude OR	95% CI	Crude OR	95% CI
High amount of work	1.7	(0.3–9.2)	1.8	(0.6–5.0)	1.7	(0.7–3.9)
High role conflict	0.6	(0.1–4.3)	1.2	(0.5–3.2)	1.0	(0.5–2.3)
High workload	2.0	(0.4–9.3)	1.0	(0.4–2.8)	1.3	(0.6–2.9)
Low skill usage	3.7	(0.8–17.7)	0.4	(0.2–1.1)	0.8	(0.4–1.7)
Low work task authority	1.4	(0.3–6.9)	0.8	(0.3–2.2)	0.9	(0.4–2.1)
Low control over work	2.9	(0.7–12.6)	0.7	(0.3–1.8)	1.1	(0.5–2.3)
Low work control	3.1	(0.7–14.5)	0.9	(0.3–2.3)	1.3	(0.6–2.8)
Low support from supervisors	1.8	(0.4–7.8)	1.2	(0.5–2.8)	1.3	(0.6–2.7)
Low support from co-workers	7.1	(1.2–43.2)	3.1	(1.2–7.5)	3.4	(1.6–7.4)
Low feedback	4.5	(0.7–28.0)	3.2	(1.1–9.5)	3.5	(1.4–8.9)
Low work status	0.6	(0.1–3.5)	1.3	(0.5–3.7)	1.0	(0.4–2.5)
Intraorganizational tensions	1.5	(0.7–3.3)	1.1	(0.7–1.7)	1.2	(0.9–1.8)
High workload/low control	9.3	(1.2–73.0)	1.3	(0.5–3.5)	2.0	(0.8–4.9)
High workload/low support from co-workers	4.0	(0.6–28.4)	2.5	(0.8–7.7)	2.8	(1.1–6.9)
High workload/low support from supervisors	8.0	(0.6–106.9)	3.8	(1.1–12.8)	4.4	(1.5–12.9)
High workload/low control/low support from co-workers	– ^a	–	– ^a	–	2.3	(0.9–6.3)
High workload/low control/low support from supervisors	– ^a	–	– ^a	–	1.6	(0.6–4.7)
Low workplace satisfaction	2.6	(0.5–13.1)	1.3	(0.5–3.6)	1.6	(0.7–3.7)
Low overall work satisfaction	3.0	(0.6–15.8)	1.0	(0.4–2.8)	1.4	(0.6–3.3)
Ongoing reorganization	1.5	(0.3–7.8)	0.5	(0.2–1.2)	0.6	(0.3–1.4)
Worry	1.0	(0.1–8.2)	0.8	(0.3–2.1)	0.9	(0.4–2.0)
Lack of information	1.9	(0.5–7.3)	2.0	(0.8–5.3)	1.9	(0.9–4.2)

^aNo analysis was possible due to a too small number of cases.

increased risk levels among men seldom reached significant strength on the 95% level, which is, at least partly, due to the small proportion of men in the sample.

Multivariate Assessment

In this part of the analysis the psychosocial indicators that were found to have a significant effect on the risk of having symptoms in the bivariate analyses were analysed, adjusted for the confounders discussed above. The small size of the study population made it difficult to do separate multivariate analyses of both sexes, as women constituted close to 3/4 of the sample.

As shown in Table 2, the increased risk levels remained on a significant level, or close to it, after controlling for the different confounders. Thus, the effect of these psychosocial factors on the risk of having symptoms seems to be quite stable.

There has been a discussion, at least in Sweden, if reported symptoms are of multifactorial origin; that exposure to more than one risk factor might be needed. An

association between electromagnetic fields and self-reported symptoms has previously been reported from *The Office Illness Project*.¹⁸ Therefore we wanted to test if any interactions between those factors and psychosocial factors occurred. It was found that among those exposed to high electric fields and low support from co-workers, eight of nine subjects (89%) had skin symptoms, compared with eight of 16 subjects (50%) among those reporting high electrical fields but high support from co-workers. An interaction variable including these two indicators showed that the high exposure category, i.e. low support/high electrical fields, had a significantly higher risk of having symptoms (OR = 10.9, 95% CI: 1.3–91.5), compared with the high support/low electric field-category. We also found that all eight respondents exposed to high electric fields and high workload/low support from supervisors were reporting skin symptoms. Among those exposed to high electrical fields but reporting low workload and high support from supervisors, only half of them (two of four) reported skin symptoms.

TABLE 2 *Unmatched analyses of psychosocial risk factors adjusted for atopic dermatitis, video display terminal (VDT)-related magnetic field, background electric field and amount of VDT work*

Psychosocial risk factors	Adjusted for	OR (95% CI)
Low support from co-workers	Atopic dermatitis	3.4 (1.5–7.7)
	B -field, ELF. rms	3.5 (1.6–8.0)
	Background electric field	4.6 (1.9–11.1)
	>4 hours VDT-work/day	3.8 (1.7–8.7)
	All the above	3.8 (1.4–10.3)
Low feedback	Atopic dermatitis	3.2 (1.2–8.6)
	B -field, ELF. rms	3.2 (1.2–8.6)
	Background electric field	2.8 (1.08–7.5)
	>4 hours VDT-work/day	3.0 (1.1–7.9)
	All the above	3.0 (1.07–8.5)
High workload and low support from supervisors	Atopic dermatitis	4.0 (1.3–12.6)
	B -field, ELF. rms	3.7 (1.2–12.1)
	Background electric field	4.0 (1.2–13.1)
	>4 hours VDT-work/day	4.1 (1.3–13.2)
	All the above	4.4 (1.3–15.0)
High workload and low support from co-workers	Atopic dermatitis	2.4 (0.94–6.2)
	B -field, ELF. rms	2.5 (0.98–6.6)
	Background electric field	2.8 (1.08–7.5)
	>4 hours VDT-work/day	2.8 (1.06–7.2)
	All the above	3.0 (1.09–8.2)

DISCUSSION

The results of this study indicate that the psychosocial work environment is important for the understanding of self-reported skin symptoms among VDT workers, which is consistent with the extensive research focusing on the relationship between psychosocial factors and different health outcomes.

Social support from co-workers seems to have a 'main' effect on the risk of having skin symptoms. We also found support for an interaction between high electrical fields and (1) *support from co-workers* and (2) *high workload/low support from supervisors*. Even if the sample size implies that this must be interpreted with caution, it indicates that there might be reason to pay attention to interactions between different potential causal agents.

Among the items constituting the variable *worry*, only 'worried about being ill as a result of one's work' showed any significant association with skin symptoms. The causality is not clear though; being anxious because one's work might cause illness could of course be a result of perceived symptoms. A reciprocal process is also plausible.

Lack of information was connected with skin symptoms in the bivariate analysis, although not significantly. An explanation for this might be that lack of information implies insecurity or worry which in turn affects health. Using a χ^2 -test, a significant association ($P < 0.05$) between information and worry was found showing that those perceiving lack of information were also often worried. To establish the causality between the two factors is, however, difficult. It is conceivable that there is an 'information/worry-dimension' connected with symptoms, which has to be explored further.

People with skin symptoms, i.e. the cases, were found to have higher prevalences of other symptoms as well, compared to referents. A χ^2 -test showed a significantly higher prevalence ($P < 0.05$) of general symptoms, i.e. fatigue, feeling heavy-headed, headache, nausea/dizziness, as well as mucosal symptoms; i.e. itching, burning or irritation of the eyes, irritated, stuffy or runny nose and hoarse, dry throat and cough among cases compared to referents. In addition, among cases reporting an adverse psychosocial work environment, skin symptoms more often went hand-in-hand with other symptoms, than among others. The implication of this is that more complex symptom patterns should be addressed in future research to find out if it is possible to distinguish between different subgroups, or syndromes. There is a close link between facial skin symptoms and 'hypersensitivity to electricity'.²⁹ However, our results do not allow us to draw any conclusions concerning the relationship with 'hypersensitivity to electricity'. Even if there is a close link between the two there might be reason to distinguish between them as they seem to differ from each other psychologically.³⁰

Stratifying by sex revealed some interesting findings. First, *high workload, low work control* and *low skill usage* were connected with a higher, though insignificant, risk of skin symptoms only among men. Second, the use of a model similar to the one proposed by Karasek showed that the highest risk level, which was of significant strength, was found among those having 'active jobs'. Stratifying by sex showed that this was true only for females. Among men, a significantly higher risk was found in 'high-stress jobs', as postulated in the model. Even if there is some uncertainty in the calculated risk levels, this implies that the association between psychosocial factors and health might differ between men and women; at least in this context.

It is possible that the questionnaire used needs to be developed and refined with the intention of explaining the differences found between males and females. In addition, in future research, non-work stressors and

their impact on health outcomes should be taken into account. These are probably of greater importance for female workers than for male workers.^{31,32} For the full-time employed wife and mother, paid work and the responsibility of a family and household could be overburdensome. It has also been found that women are more susceptible to the negative effects of non-work stress.³²

We do not think that skin complaints should be regarded solely as a psychosomatic disorder caused by psychosocial distress. However, we believe that it is not possible to explain these symptoms without considering psychosocial factors. Psychosocial stress can bring about somatic diseases as well as making the individual more susceptible to other risk factors in their environment. It may not be possible to exclude 'unknown' variables that produce spurious associations between psychosocial factors and symptoms but it is more likely that people suppress adverse psychosocial factors at work, to avert the risk of being regarded as not having 'a real disease'. It is also possible that a correlation between psychosocial factors and psychosomatic complaints is true only for certain groups of people.

In conclusion our results show that psychosocial factors in the work environment, especially social relations, are significant for an understanding of self-reported skin symptoms among VDT workers. Therefore, this must be included in future studies. Different symptom patterns should be explored and therefore interdisciplinary studies are recommended. Separate analyses for men and women could also be fruitful.

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