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A Prevalence Study of the Sick Building Syndrome (SBS) and Facial Skin Symptoms in Office Workers

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Abstract

The prevalence of symptoms compatible with the Sick Building Syndrome (SBS) was measured in a questionnaire study among 4 943 office workers. An assessment of the relation between SBS symptoms and personal, physical and psychosocial exposure factors was made. In contrast to males, the majority of females were lower-grade staff. Females reported annoyance from physical climate factors more often, both at work and at home. Males reported a better psychosocial situation than females. Female gender, asthma/rhinitis, paper and VDT work were related to an increased prevalence of SBS symptoms. The prevalence of facial skin symptoms increased markedly with the amount of VDT work. Psychosocial workload intensified this relation. Inequalities in physical climate and psychosocial conditions associated with different positions held in the offices can be of importance for the increased occurrence of symptoms among females.

KEY WORDS:
Questionnaire study, Personal factors, Physical factors, Psychosocial factors, VDT work, Paper work

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Introduction

During the past 25 years health problems related to indoor climate have received increased attention. "Sick" buildings were reported in the fifties but have become a major occupational health problem in the last decade.

In 1982 a World Health Organization expert group described the Sick Building Syndrome (SBS) as a combination of general symptoms, i.e. mental fatigue and headache; irritation of the eyes, upper and lower airways and skin symptoms, e.g. erythema and dry skin (WHO, 1983). This definition, basically derived from US and Scandinavian reports, is merely a list of symptoms reported among inhabitants of buildings with indoor climate problems and is not a widely accepted clinical syndrome. The prevalence of SBS, or symptoms compatible with SBS, in the general population is practically unknown.

Early literature in this field was comprised predominantly of case reports. During the last few years, cross-sectional studies from the UK, Denmark, Sweden, Finland and the Netherlands (Burge et al., 1987; Skov et al., 1989; Skov et al., 1990; Norbäck and Edling, 1991; Jaakkola et al., 1991; Zweers et al., 1992), reporting prevalence and risk assessments, have been published. Some of the major risk factors for SBS symptoms reported are atopy, female gender, low job category, unfavourable psychosocial factors, paper and video display terminal (VDT) work and mechanical ventilation.

Facial skin symptoms related to VDT work have been reported since the late seventies, mainly from Norway (Nielsen, 1982; Tjønn, 1984) and Sweden. They have become of major concern to offices and to the local health services, as well as a topic of considerable controversy in Sweden. The symptoms reported have shown apparent similarities with skin symptoms reported from buildings with indoor climate problems (Stenberg, 1989) and a connection between indoor climate factors and VDT work has been suggested (Tjønn, 1984; Stenberg, 1987; Wahl-

berg and Stenberg, 1991). Similar to the early reports on SBS, most reports on VDT-related skin symptoms have been case reports. Two Swedish cross-sectional studies have been published. In a questionnaire study of 550 office employees (Knave et al., 1985), VDT operators reported more skin disorders than selected referents. In conjunction with the questionnaire study, 74 persons who complained of skin symptoms were examined by occupational dermatologists (Lidén and Wahlberg, 1985). They noted a tendency for a group of diagnoses, i.e. seborrhoeic eczema, acne and rosacea, to be more frequent among the VDT workers than among the control group of office workers. In a questionnaire study an exposure-response relation between facial skin complaints and amount of VDT work has been reported (Berg et al., 1990).

This study is one part of an interdisciplinary project called The Office Illness Project in Northern Sweden. The project was initiated with the questionnaire study in late 1988. The hypothesis guiding the project assumes that the perception of health, the outcome studied in the project, is a result of physical and psychological predisposing factors and physical, chemical and psychosocial exposure. Perception of the physical and psychosocial environment, reflecting exposure as well as predisposition, holds a position between exposure and perceived health. Different levels of perception interact. If symptoms are perceived, attention may be alerted to possible exogenous exposure and vice versa. Only parts of the hypothesis could be explored in the questionnaire study. The structure of the main part of the project appears in Figure 1. The questionnaire study was the basis for two case-referent studies on SBS in office workers and facial skin symptoms in VDT workers; the outcome thus is focused on SBS and skin symptoms. As building factors, indoor climate, electromagnetic fields and sociological factors are investigated in the case-referent studies; this study addresses personal factors and non-building-related work conditions in the first place.

The aims of the present study among office workers were:

- to determine the prevalence of perceived SBS symptoms (including skin symptoms) and the association between their occurrence and personal factors such as gender, age, smoking habits and atopy;
- to describe perceptions of psychosocial factors and indoor climate at work;
- to assess the relation between symptoms and psychosocial factors and exposure factors of relevance for the indoor climate at work and at home.

Materials and Methods

The Study Population

Health problems related to the indoor environment have been reported from different kinds of buildings and from different trades. Since the office is an indoor work environment of increasing importance, the source population for the study consisted of of-

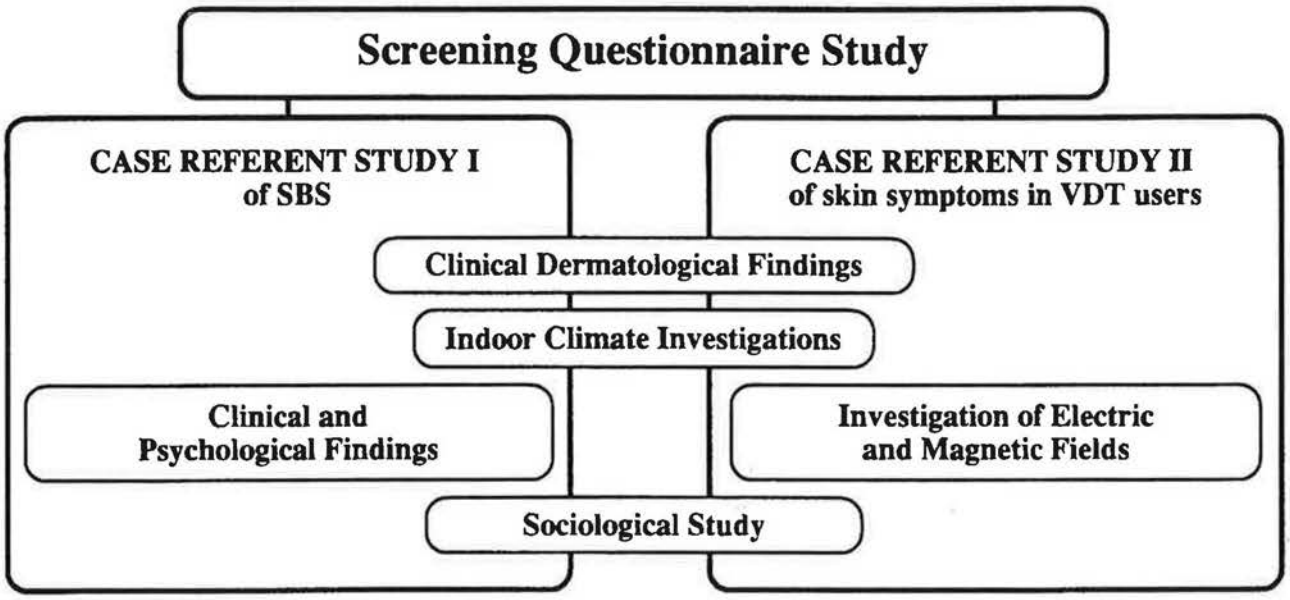

Fig. 1 The structure of the Office Illness Project in Northern Sweden.

fice workers in the county of Västerbotten, the primary catchment area for the University Hospital of Umeå. From offices listed by the county Labour Inspectorate, a proportional stratified sample was drawn so as to be representative of the number of offices in three cities, one with an inland climate and few industries and two coastal cities, one industrialized and the other the administrative centre of the county. The minimum number of employees was set at ten per office and the chances of an office being included were proportional to the number of its employees. All workers spending more than half their working hours in the office building during the three preceding months were included in the study population. The questionnaire was mailed to 5 986 office workers, constituting approximately one third of all office employees in the county. The study was designed to yield a sufficient number of cases for the subsequent case-referent studies. The county of Västerbotten is situated in the northern part of Sweden. The mean outdoor temperature ranged from +10.0 to –8.3 centigrade during the period from September to December 1988.

The Questionnaire

The questionnaire has been used in Sweden for some years in extensive surveys and most of the questions have been validated previously. In preliminary data from the supplier of the questionnaire the sensitivity of questions on general and mucosal symptoms was 70-100% (unpublished data). In a pilot study we found the sensitivity of dermatological questions to be 60-70%. The specificity for all questions was high, 90-100%. The validation of all symptom questions, based on a patient's symptom history and signs on clinical investigation, applies to the period during which the symptoms were prevalent. The questionnaire included questions concerning demographic and personal factors, work characteristics and conditions, building characteristics and other factors of relevance for the indoor climate at work and at home, perception of psychosocial conditions and physical climate and perceived symptoms. Work-related symptoms were not addressed in the questionnaire. There was one question asking whether the respondents attributed perceived symptoms to indoor climate factors. The questionnaire variables analysed in this paper are summarized in Table 1. Data acquisition lasted from late October until December 1988. A recall period of three months was used for symptoms.

The return rate was 95.7%, but 13% had to be excluded, the main reasons being absence from work during the period under study or not fulfilling the criterion of spending at least half their working hours in the office. Due to the low drop-out rate, the analysis of non-response was limited to telephone interviews with forty people. The most frequent reasons for not responding were "forgetfulness", "haven't got time","quit work" and "tired of questionnaires". Nothing indicated that perceived symptoms had influenced the willingness to respond. The proportion of missing values was low, for symptom questions 1-1.5%. A total of 4 943 questionnaire forms have been processed.

Definitions

As the questions on "asthmatic symptoms" and "hay fever" in the questionnaire did not fully cover

Table 1 Questionnaire variables analysed in this paper

Personal factors	*Work place factors*
gender	socioeconomic class (position)
age	public/private employment
smoking habits	working hours
asthma/rhinitis	age of building
	type of room
Residential factors	signs of water/mould/structural problems
living area	VDT work
type, age and size of dwelling	handling of paper
heating and ventilation system	*Perceptions*
wall-to-wall carpets and pets	indoor climate factors at home
environmental tobacco smoke	indoor climate factors at work
signs of water/mould/structural problems	psychosocial conditions at work
condensation on windows	
	Perceived symptoms
	single symptoms
	groups of symptoms
	SBS

Table 2 Construct of "indoor climate index"

Variable	Index
Draught	0-2
Temperature too high	0-2
Temperature too low	0-2
Stuffy "bad" air	0-2
Dry air	0-2
Unpleasant odour	0-2
Static electricity, often causing shocks	0-2
Passive smoking	0-2
Noise	0-2
Light that is dim or causes glare or reflections	0-2
Index sum	0-20

Table 3 Construct of "psychosocial" index

Variable	Index
Interesting/stimulating work	0-3
Too much work to do	0-3
Opportunity to influence working conditions	0-3
Index sum	0-9

the concept of atopy, "asthma/rhinitis" was preferred as a designation for those answering "yes" to one or both of those questions. The employees were ranked in three categories, "lower", "middle" and "higher" post, according to length of education and position. These designations, derived from the Swedish official socioeconomic classification, SEI (Statistics Sweden, 1982), concord with the Anglo-Saxon categories – clerical, professional and managerial. "Lower" employees had less than three years and "middle" had three to six years of additional education after the nine-year compulsory school. Both could have subordinates. "Higher" employees normally had more than six years' supplementary education and/or held a leading position in the office. The workers were labelled publicly or privately employed depending on union affiliation.

The amount of VDT work was measured with questions about "work with VDT" and should consequently be interpreted as a measure of the amount of active work with a VDT. As a measure for exposure to electromagnetic fields it is, of course, an approximation.

Several indices have been constructed to facilitate the analysis of data. "Paper index" sums up the frequency of work with carbonless copy paper, disposable carbon paper, printer paper and photocopies, each paper being given the same weight from the point of view of exposure. The index value 3 refers to "daily" handling of paper, 2 to "large amounts occasionally", 1 to "small amounts sporadically" and 0 refers to "never". Tables 2-4 depict the construct of an "indoor climate index", a "psychosocial index" and four symptom indices respectively. For all questions about perceptions of physical factors and symptoms the value 0 refers to the answer "no, never", 1 to "yes, sometimes" and 2 to "yes, often". Often means every week. The questions on psychosocial conditions have four possible answers, "yes, often", "yes, sometimes", "no, seldom" and "no, never". The answers were given values 0-3 respectively, with one exception. In the question about workload, both extremes were given the value 3 and the answers "yes, sometimes" and "no, seldom" 0. Both extremes were judged to be equally negative.

Table 4 Construct of symptom indices

	Index			
	General symptom	Mucosal symptom	Skin symptom	Total symptom
Fatigue	0-2			0-2
Feeling heavy-headed	0-2			0-2
Headache	0-2			0-2
Nausea/dizziness	0-2			0-2
Difficulties concentrating	0-2			0-2
Itching, burning or irritation of the eyes		0-2		0-2
Irritated, stuffy or runny nose		0-2		0-2
Hoarse, dry throat		0-2		0-2
Cough		0-2		0-2
Dry facial skin			0-2	0-2
Flushed facial skin			0-2	0-2
Itching/stinging/tight or burning sensations on facial skin			0-2	0-2
Index sum	0-10	0-8	0-6	0-24

An increment of index values signals an increasing exposure load or increased number of perceived symptoms.

An "SBS-case", later used in one of the case-referent studies, was defined as an employee reporting at least one general symptom every month and at least one mucosal and one dermatological symptom every week. The same symptoms as those in Table 4 were used. The criterion for general symptoms had to be broadened from weekly to monthly occurrence in order to generate a sufficient number of cases for the subsequent case-referent study.

Statistical Methods

The chi-square test was used to assess broadly the relation between perceptions of the physical climate, perceived symptoms and the determinants. In the analysis of the relation between perceived symptoms and determinants, SBS-case, total and skin symptom indices were used in most instances. All stated relations between perceptions and determinants or stated differences between males and females are significant at $p < .05$. The odds ratio (OR) was chosen to describe the strength and the precision of some of the occurrence relations of special interest. For the estimation of a uniform odds ratio in a stratified analysis the Mantel-Haenszel procedures were used. Confidence intervals were estimated using Miettinen's test-based method. When using indices for analysis the distribution of each index was grouped into three classes (0-2), of approximately equal size. Index class 2 thus represents the upper part of the distribution. In the multivariate analysis an unconditional logistic regression analysis was performed using the EGRET package.

Results

The data analysed are extensive and the results will be published in a series of papers with focus on different issues. This paper presents an overview of the office environment and the load of perceived symptoms as reported by the workers. It presents patterns and, in selected instances, details. The rationale is not mere space but also the fact that relations based on questionnaire data cannot be compared in detail with other questionnaire data. Differences in methods and phrasing affect the relations. Strong relation patterns, however, may be generally applicable. In a paper specifically addressing the male/female contrast, more detailed information about the distribution of the determinants and their relation to perceived symptoms are presented (Stenberg and Wall).

Personal and Predisposing Factors

The sex distribution was 52% females and 48% males. The median age among females and males was 41 and 42 years respectively. Among women 15% were below 30 and 23% over 50 years of age. The corresponding proportions among men were 11% and 27%. Every third woman and every fifth man smoked. Younger females especially were frequent smokers. Asthmatic symptoms were reported by 10% of both sexes. Hay fever was reported by 16% of males, as compared to 12% of females. Asthma/rhinitis occurred in 19% of males and 18% of females.

Exposure

Residential Factors

Two thirds lived in detached or terraced houses. Females lived in smaller dwellings and more often in apartment houses than males. Most dwellings had waterborne heating and natural ventilation with a kitchen fan. No differences were noted between the sexes in this respect. As expected, smoking was more frequent in dwellings of female office workers. Water damage was reported in 10% of the dwellings. Structural damage was more common in apartment houses.

Work Factors

A majority, 59% of males and 76% of females, were employed in the public sector. Women were mostly "lower" employees, men mostly "middle" or "higher". Consequently more women than men worked in open-plan offices. Nearly 50% of females were part-time workers as compared to 15% of males. Signs of water damage in the work room were reported by 3%, in the office building by 18%.

Two thirds of both females and males reported working with VDTs. Of these, 30% had less than one hour and 20% more than four hours of daily VDT work. Paper work was more common among women, especially work with carbonless and disposable carbon paper. Printer paper was handled more often by men, photocopies equally often by both sexes. In this population VDT work was associated with an increment in paper load, in contrast to visions of "the paperless office".

Perceptions of Physical Factors

In their dwellings, men and women had the same ranking of complaints about physical factors. Dry

air, static electricity, draughts, too low temperature and stuffiness were the most common complaints. Among females, dry and stuffy air was perceived more often in apartment houses and in dwellings with electric heating and mechanical ventilation than in buildings with waterborne heating and natural ventilation. Condensation on windows during winter was more common in dwellings with natural ventilation, indicating a higher relative humidity due to lower ventilation rates.

At work the prevalence of complaints concerning physical factors was about five times higher than that for dwellings. Dry and stuffy air was by far the most common complaint in both sexes. Weekly complaints about dry air were reported by 43% females and 17% males and stuffy air by 27% and 15% respectively. While draughts and too low a temperature were common complaints among females, too high a temperature was a common complaint among males. The indoor climate index was higher among females. In a bivariate analysis stratified for each sex the following factors were associated with a high indoor climate index: young age among females; and asthma/rhinitis, private employment, open-plan offices, VDT and paper work in both sexes. Analysis of the perception of dry air yielded similar results.

Perceptions of Psychosocial Factors

Men more often reported interesting and stimulating work as well as a greater opportunity to influence work conditions. They also reported a greater workload. The psychosocial index was lower among males, probably implying a higher position in the office. This index was also lower in public employment and decreased with an increasing amount of VDT work up to four hours a day. Above that the index increased. An increment in paper work was followed by a slightly increased index. Thus, if psychosocial factors are related to symptom prevalence, they will act as confounders when assessing the relation between symptoms and VDT and paper work.

Table 5 Prevalence (%) of symptoms perceived every week among males and females

Symptom	Males %	Females %
Fatigue	16.0	28.2
Feeling heavy-headed	7.7	15.3
Headache	5.6	14.6
Nausea/dizziness	1.1	2.9
Difficulties concentrating	2.7	3.1
Itching, burning or irritation of the eyes	7.4	15.9
Irritated, stuffy or runny nose	9.4	12.3
Hoarse, dry throat	5.1	9.3
Cough	2.1	3.3
Dry facial skin	8.1	24.4
Flushed facial skin	4.6	8.5
Itching/stinging/tight or burning sensations on facial skin	3.0	8.1
Scaling/itching scalp or ears	8.6	9.9
Dry, itching red skin on hands	3.9	10.1
Total number of individuals	2351	2592

Symptoms and Personal/ Predisposing Factors

Table 5 depicts prevalences of symptoms perceived every week during the last three months.

All symptoms, apart from difficulty in concentrating and scaling/itching scalp, were more prevalent among females. Eye, throat, and nose symptoms, feeling heavy-headed and facial skin complaints were the symptoms most commonly attributed to indoor climate factors. One in four had sought medical treatment for one or several symptoms and every other person stated that the symptoms were independent of season.

In the study population the prevalence of SBS-cases was 4% among men and 12% among women. The OR for being an SBS-case was 3.4 (95% CI: 2.7-4.2) for females compared to males. SBS-cases, general and skin symptoms were more prevalent under fifty years of age; among females SBS-cases were most prevalent under forty. The sex and age distribution of SBS-cases and people with a high skin symptom index is shown in Table 6.

Due to the great differences in symptom prevalence between females and males the following relation assessments were stratified for sex.

Smoking was not associated with any increase in symptom indices whereas asthma/rhinitis entailed an increment of all symptom indices. Reflecting this finding, SBS-cases were uniformly distributed among smokers and non-smokers but were more abundant among people with asthma/rhinitis. The

Table 6 Prevalence (%) of SBS and high skin symptom index (index class 2) in different age groups among males and females

Age group	SBS		High skin symptom index	
	Males	Females	Males	Females
-29	5.0	12.5	20.6	40.9
30-39	3.1	12.7	22.7	43.5
40-49	4.1	11.7	20.8	42.8
50-59	4.0	11.5	17.4	34.7
60-	3.3	8.1	12.8	35.4
Total	3.9	11.9	20.1	40.9

occurrence of SBS-cases or different symptom indices did not differ between the regions.

Symptoms and Exposure Factors

With the exception of a tendency to have a higher total symptom index among females living in apartment houses and males living in dwellings with mechanical ventilation, total symptom index and SBS-case prevalence were not related to type of dwelling, heating or ventilation systems. Signs of damage in the dwelling did not entail increased prevalence of SBS, nor did presence of wall-to-wall carpets or pets.

Total symptom index and SBS-cases were not significantly related to position or private or public employment. Total symptom index was higher among females working in open-plan offices when compared to private rooms.

Signs of damage in the work room were not related to increased prevalence of SBS but among males the prevalence was raised among those who reported signs of damage within the office building.

Two non-building-related factors of potential importance for SBS-symptoms in general and skin symptoms in particular are VDT and paper work. The controversy relating to their importance as risk factors justifies the search for further details concerning them.

VDT Work

An exposure-response relationship between all skin symptoms included in the skin symptom index and the amount of VDT work was established. Table 7 depicts the crude odds ratios for being an SBS-case and of having the highest class skin symptom index.

Among males, VDT work raised predominantly the prevalence of skin symptoms but also to some extent mucosal and general symptoms reflected in an increased prevalence of SBS. For females, who generally had a higher prevalence of symptoms, only skin symptoms included in the index, i.e. dry, erythematous and irritated facial skin, showed a significant increment. Female VDT users reported facial erythema every week in 9.4% compared with 6.8% among non-users ($p < .05$). Besides index symptoms the odds ratio for itching and scaling of scalp/ears was elevated among males. Standardization for age, asthma/rhinitis or paper work did not change this pattern. When stratifying for psychosocial index, a potential confounder, an additive effect of psychosocial load on the odds ratio for skin symptoms in VDT work was demonstrated (Figure 2).

Table 7 Crude odds ratios for SBS-cases and high skin symptom index at different amounts of VDT work among males and females

Symptom	VDT exposure	Odds ratio		95% C.I.	
		Males	Females	Males	Females
SBS	0	1.0	1.0	-	-
	<1 h/day	1.06	1.06	(0.50-2.2)	(0.74-1.51)
	1-4 h/day	2.1	1.31	(1.19-3.6)	(0.97-1.77)
	>4 h/day	2.3	1.30	(1.23-4.1)	(0.90-1.88)
Skin	0	1.0	1.0	-	-
symptom	<1 h/day	1.25	1.22	(0.90-1.75)	(0.97-1.55)
	1-4 h /day	1.99	1.70	(1.53-2.6)	(1.39-2.1)
	>4 h/day	2.8	2.1	(2.1-3.7)	(1.62-2.7)

Table 8 Crude odds ratios for SBS-cases and high skin symptom index at varying amounts of paper work among males and females

Symptom	Paper exposure index class	Odds ratio		95% C.I.	
		Males	Females	Males	Females
SBS	0	1.0	1.0	-	-
	1	1.38	1.20	(0.78-2.4)	(0.84-1.73)
	2	1.98	1.65	(1.18-3.3)	(1.22-2.2)
Skin	0	1.0	1.0	-	-
symptom	1	1.29	1.04	(0.99-1.68)	(0.83-1.31)
	2	1.74	1.45	(1.36-2.2)	(1.19-1.77)

Employment position did not affect this association significantly and when stratifying for sex the same pattern was seen among males and females, although with higher amplitudes among males.

Paper Work

The relation between symptoms and paper work are presented in a similar manner as for VDT work in Table 8.

Among both males and females the symptom pattern was much the same as for VDT work. An increased relative risk of skin symptoms on the hands also appeared. Standardization for age, asthma/rhinitis and VDT work had no significant impact on odds ratios. An additive effect from paper work and psychosocial work on the odds ratio for SBS-symptoms was demonstrated (Figure 3).

Employment position had no effect on this association and, as for VDT work, the pattern seen in Figure 3 was strengthened among males.

Multivariate Analysis

The prevalence of SBS was strongly related to female gender, asthma/rhinitis, psychosocial condi-

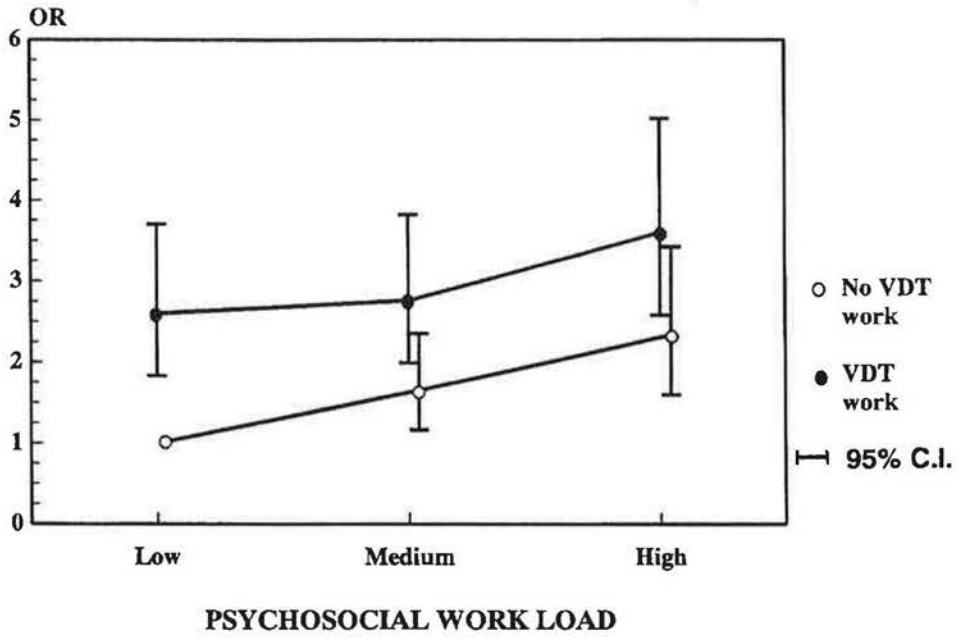

Fig. 2 Odds ratios for high skin symptom index at varying amounts of VDT work and psychosocial load. Odds ratios standardized for gender. Test for trend $p < .001$.

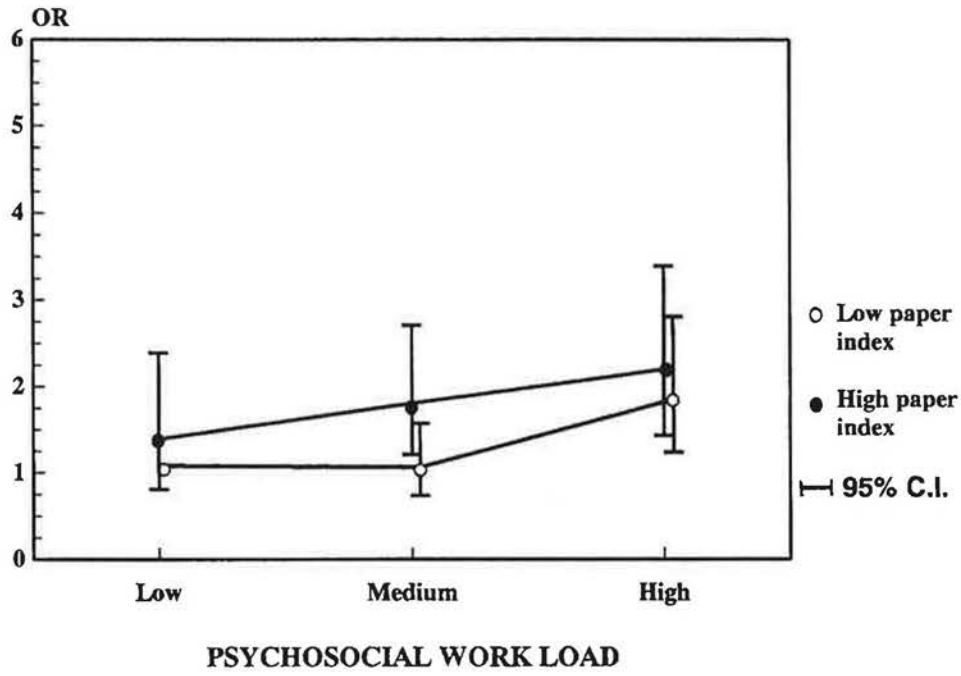

Fig. 3 Odds ratios for SBS-cases at varying amounts of paper work and psychosocial load. Odds ratios standardized for gender. Test for trend $p < .001$.

tions and paper work. These factors represent a set of important constitutional, psychosocial and physical conditions. They were entered into a logistic regression analysis in order of mention to illustrate their relative strength as risk indicators for SBS. A similar analysis was performed for facial skin symptoms using "high skin symptom index" as outcome and replacing paper work with VDT work. Tables 9 and 10 depict the results showing that they all keep their position as significant risk indicators. The strength of female gender as a risk indicator was clearly demonstrated. For SBS the odds ratio decreased only from 3.4 (crude) to 3.2 in the multivariate analysis. For skin symptoms it even increased, from 2.7 (crude) to 2.8.

Discussion

The results from this study yielded complex patterns and relationships. Most prominent was the

Table 9 Logistic regression analysis of gender, asthma/rhinitis, psychosocial conditions and paper work as risk indicators for SBS

Variable		Odds ratio	95% C.I.
Female gender		3.2	2.4-4.1
Asthma/rhinitis		2.1	1.64-2.7
Ps.soc. index	medium	1.14	0.83-1.55
	high	1.61	1.16-2.2
Paper index	medium	1.19	0.87-1.62
	high	1.60	1.22-2.1

Table 10 Logistic regression analysis of gender, asthma/rhinitis, psychosocial conditions and VDT work as risk indicators for high skin symptom index

Variable		Odds ratio	95% C.I.
Female gender		2.8	2 5-3.2
Asthma/rhinitis		1.44	1.22-1.69
Ps.soc. index	medium	1.19	1.00-1.42
	high	1.61	1.32-1.95
VDT work	0-1 h/d	1.25	1.02-1.52
	1-4 h/d	1.87	1.59-2.2
	4- h/d	2.4	1.97-2.9

discrepancy in perceptions between males and females. This difference in perceived health could not be explained by the personal and predisposing factors dealt with in this study. For example asthma/rhinitis, an important determinant for symptoms, was distributed quite uniformly among males and females. Effect modification was observed for VDT work and skin symptoms in the sense that prevalence increment was greater among males. This may be explained by the lower overall prevalence of skin symptoms among males, leaving substantial room for reaction to exposure compared to females.

Dissimilar perceptions of physical climate indicate inequalities regarding indoor climate in which males and females live and work. The main risk indicators for symptoms were also associated with perceptions of a bad indoor climate. This supports the hypothesized connection between perception of health and perception of climate. Whether this also implies that man is a useful instrument for assessing indoor climate has to be confirmed by measurements of the actual climate. Such studies at the work site form another part of this project.

Paper and VDT work, two important risk indicators for symptoms, might explain some of the different symptom prevalences among males and females. While VDT work was distributed quite uniformly, paper work was more prevalent among females and there were also differences regarding type of paper handled. Females more often handled carbonless copy paper which formerly has been associated with SBS-like symptoms (Calnan, 1979). Moreover, diverging perceptions of psychosocial conditions associated with different positions held in the office point to a very important field to explore. Psychosocial factors appeared as important risk indicators for perceived symptoms, additional to VDT and paper work. These observations underline the importance of the sociological part of the project. In future reports the gender issue will be further analysed using data from other parts of the project. The importance of building-related risk indicators will be analysed in reports from the case-referent studies where such factors have been studied at the work places.

In contrast to a widely held view (Hedge et al., 1989), public employment in general was not associated with a significantly increased prevalence of symptoms in this study. Otherwise our results are in close agreement with the findings of the Office Environment Survey (Burge et al., 1987), the Town Hall Study (Skov et al., 1989, Skov et al., 1990) and the studies by Norbäck and Edling (1991), Jaakkola et al. (1991) and Zweers et al. (1992). The main risk indicators for symptoms are the same. Norbäck and Edling (1991) found the same predominance of symptoms among females, though not after adjustment for nickel allergy, unspecific hypersensitivity and infection proneness. In our view, nickel allergy is a consequence of lifestyle differences among females and males, e.g. use of bijouterie. Although it is unevenly distributed among males and females, nickel allergy as such is hardly a risk factor for SBS. Its importance may be as an indicator of a lifestyle increasing the risk of SBS symptoms. These considerations are not applicable to contact allergy in general. Both unspecific hypersensitivity and infection proneness are included in the WHO definition of SBS and may thus be either part of the outcome or potential confounding factors.

Both the Office Environment Survey and the Town Hall Study deal with work-related symptoms. In agreement with Norbäck and Edling (1991) we have chosen to study symptoms regardless of work-relation as this additional criterion adds to the subjectiveness of the response estimate. Many symptoms can be work-related but do not fluctuate fast enough to be improved over weekends or shorter absences from work. Mitigation following a summer holiday may be a result of climatic changes, not ab-

sence from work. The drawback of our method is that true work-related symptoms will be diluted among symptoms of non-occupational etiology. When making comparisons between studies the odds ratio is a useful tool as it is independent of prevalence and thereby overcomes much of the drawback of different constructs of questions.

Skin symptoms play a central role in our study while such symptoms are not reported at all in the study from the UK. Whether this is a result of true differences in prevalence or a consequence of the phrasing of the questions or different focuses we do not know.

Being results from a questionnaire study, many findings have to be scrutinized using other methods for confirmation. The validity of the questionnaire poses one problem. In the prior validation the sensitivity was quite low for dermatological questions. Hence the period prevalence, based on patient history and clinical signs, will be underestimated by 10-30% for symptoms with actual prevalences of 0.03-0.24. On the other hand, Berg and Axelson (1990), in a questionnaire study of skin symptoms, showed that the degree of verification for diagnoses based solely on clinical signs was only 46%. Berg et al. (1990) in their study also found an exposure-response relationship between the amount of VDT work and self-reported symptoms. Clinical diagnoses, based on status on one occasion, did not however confirm this pattern. This emphasizes the importance of methods for exposure estimation not subject to potential errors such as recall bias. The question whether VDT work poses a threat to health has been intensely debated in Sweden, thereby obstructing an unbiased study. The case-referent study in the project with actual measurements of exposure for electric and magnetic fields presents one method of coping with this problem.

The design of this project, a cross-sectional questionnaire study commencing a multidisciplinary project accommodating two case-referent studies, provides validated and cost-effective instruments for studying nonfatal diseases with no clear time at onset. It must be pointed out, however, that the use of SBS or different symptom indices defined from questionnaire answers, in the study of occurrence relations, only provides a model. Findings from studies based on questionnaires cannot uncritically be related to clinical practice. Different selection mechanisms entail partly dissimilar subpopulations.

When this study was planned, many determinants with potential bearing on the indoor climate were included, leading to a weakness of the study which we share with many studies of similar design. Some determinants are actually not satisfactorily conceptualized. As for the work places, questionnaire data are supplemented with measurements in the case-referent studies, giving us better information to fall back on. In the dwellings, however, we had no resources to conduct actual measurements and we are aware of the problems of conceptualizing the impact of some of the determinants on the indoor climate. Data on the heating and ventilation systems are two such examples. Such data are therefore handled more superficially than other factors. Future studies must include valid measurements of fewer theoretically and operationally well defined determinants.

Conclusions

Female gender, asthma/rhinitis, VDT and paper work and psychosocial factors are important determinants for symptoms compatible with SBS, including skin symptoms. Their importance as risk indicators was established by stratified assessments of exposure-response relationships. Even though the background for these associations is complex, the results imply that females and males in offices work under unequal conditions as indicated by different perceptions of physical and psychosocial factors.

The implications of female gender as a risk indicator is an important issue that should receive further analysis. In that connection both a biomedical and a sociomedical perspective is essential. This study, focusing on non-building risk indicators, is supplemented by case-referent studies with emphasis on somatic, sociological and physical work place factors.

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