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# Sick Building Syndrome, Working Environments and Hospital Staff

**Key Words**Sick building syndrome  
Nurses  
Administrative staff**Abstract**

This paper examines the effect of hospital design upon the working environment, as perceived by junior nursing and administrative staff. Two London teaching hospitals were selected for investigation: the Royal Free Hospital (RFH), a modern, artificially ventilated building, and the Middlesex Hospital (MH), which is older and relies on natural ventilation. Staff were selected randomly and asked to complete a questionnaire over a 2-month period. Both staff groups at the RFH experienced a higher symptom rate than did those at the MH; this was related to a low perceived quality of the working environment, and was characterised by the perception of dryness, heat and low environmental control. The increased rate of symptoms may have resulted from inadequate function of the air-conditioning services at the RFH, due to economy measures introduced by the hospital managers. There was no increase in the rate of absenteeism from work.

**Introduction**

Modern construction techniques developed in the period after the second world war, coupled with the advances in environmental services design, have allowed buildings to become deeper in plan, quicker to erect and cheaper to build. The fuel crisis of the 1970s led to energy conservation measures, and has resulted in the development of modern hospital buildings. Very often these buildings are prefabricated, sealed, lit fluorescently and ventilated artificially.

In the early 1970s, a syndrome, sick buildings syndrome (SBS), was identified in those individuals working in this type of building. In 1983, the World Health Organisation listed eye, nose and throat irritation, dry skin and

mucous membranes, erythema, mental fatigue, headaches, increased incidence of respiratory infections, and unspecified hypersensitivity as symptoms of SBS [1]. Although the following building features have been associated with SBS – mechanical heating and ventilation systems, lack of individual control over environmental conditions, fluorescent lighting, application of energy conservation measures, and extensive use of synthetic materials and cleaning fluids [2] – no direct causal link between these features and SBS has been shown [3].

To determine if the perceived quality of the working environment, or the level of control over the environment, could influence the development of SBS, groups of individuals in similar occupations working in two different London teaching hospitals, one of which was of mod-

Age \_\_\_\_\_ Sex  masculine  
 feminine Type of job \_\_\_\_\_

Place of work  floor  ward  office

Hours per day spent in building \_\_\_\_\_

Do you work in the same ward/office for most of the day?  Yes  
 No

How many days off sick have you had in the past year? (approx.) \_\_\_\_\_

Smoking habits (per day) \_\_\_\_\_

Do you experience any of the following conditions in your workplace?

	Always	Often	Sometimes	Never
Too little air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too much air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too dry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too humid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too hot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too cold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too bright	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too dim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glare (on work surface)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too noisy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too quiet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too stuffy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too smoky	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unpleasant odours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

a

How do you rate the following?

	Very good	Good	Average	Bad	Very bad
Working environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Staff rest areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hospital accommodation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Job satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any other comments?	_____				
	_____				
	_____				

Can you control any of the following?

	Complete	Some	None	Do not know
Temperature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your workplace have a window?				<input type="checkbox"/> Yes <input type="checkbox"/> No
If so, is it openable?				<input type="checkbox"/> Yes <input type="checkbox"/> No

b

Do you experience any of the following complaints at your workplace?  
(Please state if more common in the afternoon)

	Often	Sometimes	Never	More common in afternoon
Headache	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dizziness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nausea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drowsiness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lethargy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry/sore throat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry skin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skin rash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sore eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Runny nose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stuffy nose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flu-like symptoms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Breathing difficulties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Backache	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aching limbs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you have any problems with contact lenses?				<input type="checkbox"/> Yes <input type="checkbox"/> No

c

Fig. 1. Questionnaire to ascertain the perceived quality of the working environment (a), the level of control over the environment (b), and frequency of occurrence of work-related symptoms (c) in junior administrative staff, nurses and porters.

ern construction, were examined in the present study. The hospitals were the Royal Free Hospital (RFH) and the Middlesex Hospital (MH). The modern hospital, the RFH, was built in 1978 according to a very deep plan, which resulted in many internal rooms that necessitated artificial ventilation. The building was heated by ducted hot air; two duct systems run to individual mixer units, one with air at 29 °C, the other containing slightly pre-heated air. This system was designed to allow thermostats to regulate temperature locally, each one controlling 1 of 800 mixer units. The building is lit entirely by fluorescent lights. The MH was built in 1938. In the main, it is ventilated naturally; it is heated via a conventionally sealed wet system. Having a shallow plan, most of MH's windows can be opened.

## Methods

### Sample Selection

In each hospital, 110 junior staff from three occupational groups (administrative staff, nurses and porters) were chosen at random from personnel files. The three groups were selected so as to obtain information about different working environments: administrative staff tend to remain at a single workstation or in a single office, nurses work on wards shared with patients and porters work throughout the hospital.

### The Questionnaire

Questionnaires (fig. 1), formulated from other sources [4, 5] and designed to ascertain the perceived quality of the working environment, the level of control over the environment and the frequency of occurrence of work-related symptoms were sent for completion to the selected staff between December 1990 and February 1991. Repeat questionnaires were not issued to non-respondents.

### Recording of Symptoms

Symptoms were only recorded as work-related if they were experienced 'often' or 'more commonly in the afternoon'.

### Statistical Analysis

There was considered to be an association when  $p < 0.05$  after subjecting to the  $\chi^2$  test.

## Results

### All Respondents

The response rate was similar at about 40% in both the administrative and nursing staff of both hospitals, but was much lower (8% at the RFH, 12% at the MH) for porters (table 1). As a result of this low response rate, porters were not subject to analysis.

**Table 1.** Response rates of the selected sample in the three occupation groups

Group	RFH	MH
Administrative	40	42
Nurses	44	38
Porters	8	12

Values are percentages.

**Table 2.** Percentage of respondents that was symptomatic

RFH		MH	
symptom	%	symptom	%
Dry skin	42	Dry skin	32
Sore throat	24	Headache	23
Headache	20	Sore eyes	20
Sore eyes	20	Runny nose	14
Lethargy	14	Stuffy nose	11
Drowsiness	11	Sore throat	9
Runny nose	7	Drowsiness	6
Stuffy nose	5	Lethargy	6
Nausea	2	Nausea	3

The most prevalent symptom at both hospitals was dry skin (table 2); the incidence at the RFH was higher (42%) than that at the MH (32%;  $p < 0.01$ ). Although the overall incidence of sore throats, lethargy and drowsiness was higher at the RFH than at the MH (table 2), the increased incidence in lethargy and drowsiness at the RFH was only found in administrative staff (tables 3,4). The overall incidence of headaches did not differ significantly between the hospitals (table 2); however, the incidence was higher in nurses at the MH (table 3), and higher in administrative staff at the RFH (table 4). Runny and stuffy noses occurred more frequently at the MH (table 2). The symptom rate at 1.9 symptoms per person was significantly higher ( $p < 0.05$ ) at the RFH compared with 1 symptom per person at the MH.

### Nurse Respondents

The percentage of nurses that reported suffering from  $\geq 1$  symptom of SBS was higher at the RFH (71%) compared with the MH (46%;  $p < 0.005$ ). However, nurses at the RFH did not take off more time from work than did those at the MH, and indeed had a higher rate of job satis-

**Table 3.** Percentage of nurses that was symptomatic

Symptom	RFH	MH
Dry skin	46	35
Sore throat	28	15
Headaches	17	28
Sore eyes	17	15
Lethargy	7	7

**Table 4.** Percentage of administrative staff that was symptomatic

Symptom	RFH	MH
Dry skin	35	33
Headaches	35	19
Drowsiness	28	6
Lethargy	35	5
Sore eyes	21	23
Sore throat	14	5

**Table 5.** Symptomatic and non-symptomatic nurses' perceptions of their working environment

	Symptomatic			Non-Symptomatic		
<i>RFH</i>						
Too little air		45		25		
Too hot		70		37		
Too dry		70		37		
	some	none		some	none	
Control of ventilation	10	85		0	95	
Control of temperature	90	10		80	10	
	good	avg.	bad	good	avg.	bad
Job satisfaction	80	20	0	75	25	0
Work environment	50	37	12	20	60	5
<i>MH</i>						
Too little air		28		37		
Too hot		42		37		
Too dry		71		25		
	some	none		some	none	
Control of ventilation	80	20		75	12	
Control of temperature	57	42		37	50	
	good	avg.	bad	good	avg.	bad
Job satisfaction	70	28	0	62	25	0
Work environment	70	30	0	75	25	0

Values are percentages. avg. = Average.

faction. No correlation was found between smoking and SBS symptoms in nurses.

Nurses at the MH believed that they had greater control over the level of ventilation than did nurses at the RFH, and this belief was supported by the finding that all

the nurses with SBS symptoms at the MH and none of those at the RFH believed that they had access to an openable window (table 5). More symptomatic nurses at the RFH believed that they had some control over temperature (90%) compared with those at the MH (57%). How-

**Table 6.** Symptomatic and non-symptomatic administrative staff perceptions of the working environment

	Symptomatic			Non-Symptomatic		
<i>RFH</i>						
Too little air	75			50		
Too hot	62			16		
Too dry	25			33		
	some	none		some	none	
Control of ventilation	0	90		16	80	
Control of temperature	37	65		50	45	
	good	avg.	bad	good	avg.	bad
Job satisfaction	37	62	0	0	83	16
Work environment	0	62	38	9	83	8
<i>MH</i>						
Too little air	33			8		
Too hot	22			8		
Too dry	11			16		
	some	none		some	none	
Control of ventilation	80	20		75	12	
Control of temperature	57	42		37	50	
	good	avg.	bad	good	avg.	bad
Job satisfaction	70	28	0	62	25	0
Work environment	70	30	0	75	25	0

Values are percentages. avg. = Average.

ever, a higher proportion of symptomatic nurses at the RFH (70%) than at the MH (42%) felt that the working environment was too hot (table 5), implying that those controls were ineffective or poorly utilised. Although there was very little difference between the nurses at the RFH and MH in terms of job satisfaction, and no association between SBS symptoms and job satisfaction ( $p > 0.5$ ), the quality of the working environment was rated higher at the MH (table 5).

There appears to be an association between the development of SBS symptoms in nurses and a perception of dryness ( $p < 0.01$ ).

#### *Administrative Staff Respondents*

The average age of RFH respondents (42.0 years) was 10 years older than that of MH respondents (31.8). The percentage of administrative staff that reported suffering from  $\geq 1$  symptom of SBS was higher at the RFH (57%)

compared with that at the MH (42%). Although administrative staff at the MH suffered less SBS symptoms and were younger than RFH staff, they took off more days (13.9) than those at the RFH (7.6).

Although job satisfaction at both hospitals was high, the working environment was considered to be less satisfactory amongst those suffering SBS symptoms at the RFH than at the MH (table 6). There was an association between the occurrence of SBS symptoms and subjective assessments of the environment being dry, having too little air and being too hot ( $p < 0.05$  throughout).

#### **Discussion**

The original aims of this study were to determine the effect of the perceived quality of the working environment, and the level of control over that environment, on

the development of the symptoms of SBS in three occupation groups. Unfortunately, the response rate for one group, the porters, was so low as not to make analysis of the responses feasible. Why the response rate was low is not known, although it is interesting to reflect that all those porters who did respond answered 'never' to all questions: perhaps porters are entirely happy with their conditions. It seems more likely, however, that the questions were either not understood or that those in this relatively poorly paid post with short-term contracts of employment were concerned that criticism of working conditions would limit their chances of continued employment.

The incidence of SBS symptoms was higher at the RFH than at the MH in the other two occupation groups studied: the nurses and administrative staff. The perceived quality of the working environment was lower at the RFH. As job satisfaction was rated similarly at both hospitals, it seems likely that it is the perception of the environment that is related to the symptoms of SBS. Indeed there appears to be a link in the present study between a perception of a hot, stuffy atmosphere and the development of SBS. However, in this study, administrative staff (believed to be prone to develop SBS symptoms [6]) were older than those at the MH, and it is possible that the symptoms of SBS are increasingly prevalent with age. Interestingly, this increase in the prevalence of SBS symptoms was not matched by an increase in time taken off in sick leave, so SBS may not lead to cost in lost work-hours, although only a study on productivity whilst at work could assess this possibility.

How important the level of control is to the development of SBS is not resolved in this study. Take, for example, the possible control conferred by the presence of an openable window. Although all symptomatic nurses at the MH believed that they had access to an openable window, only 80% thought that they could control the ventilation,

and 57% thought that they could control the temperature. However, this one indicator of personal control does support previous findings [2] that where there is a loss of control over the environment, there is an increase in the number of symptoms experienced. It has been postulated [2] that this is as a result of a reduction in tolerance to poor conditions.

Consistent complaints in the present study were of apparent high ambient temperatures and dryness resulting in sore eyes, throats and skin, particularly at the RFH. Analysis of building services at the RFH revealed that the ventilation system was not humidified. Humidifiers had been fitted to the ventilation system when the hospital was first built, although they had since been turned off as an energy conservation measure. Also, there had been maintenance problems with the mixer units, and both of these factors could explain many of the symptoms reported by staff. In order to provide temperatures comfortable to both patients and staff in hospitals, the CIBSE guide [7] recommends a temperature of 18 °C, and the Institute of Service Engineers recommends temperatures no higher than 20 °C. It is possible that the temperature in both hospitals was higher than the recommended levels, and that both cost savings and a reduction in SBS symptoms could be attained by reducing the ambient temperature.

In conclusion, this study demonstrates that the symptoms of SBS in hospital staff are related to the perception of the environment and to the perceived level of control over that environment.

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