Psychosocial factors associated with sick building syndrome in a biased and unbiased population of office employees occupying two buildings in South Africa

Fig. captions and footnotes to table

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ABSTRACT

The relationship between psychosocial characteristics and sick building syndrome (SBS) was explored among 348 employees occupying two buildings engaged in the public sector in Pretoria, South Africa. One building was characterized as 'sick' (building B), whilst the other was not a known sick building (building A). Based on the Environmental Quality Survey and symptom checklist, respondents in the 'sick' building reported significantly higher levels of stress, lower levels of environmental control, lower levels of job satisfaction and lower overall environmental satisfaction. There was a significant relationship between job stress, job satisfaction and overall environmental satisfaction and the number of SBS symptoms reported by employees in each building. Multiple regression analysis revealed these variables significantly explained the variance in the number of symptoms reported in each building. The associations between psychological symptoms and symptoms characteristic of SBS suggest that SBS symptoms may be attributed to psychosocial factors, or at least be psychologically mediated.

INTRODUCTION

Research findings related to social, psychological and organizational factors and sick building syndrome (SBS) centre around the concept of stress and its role in physical and mental health (Mendelson *et al*., 2000; Gunnarsson and Berglund, 2002). Persistent exposure to these indirect stressors may precipitate physiological stress responses and consequent ill health effects, effects on morale and productivity (Brooks and Davis, 1992). Morris (1987, p. 5) provides a model to depict the interaction of these variables.

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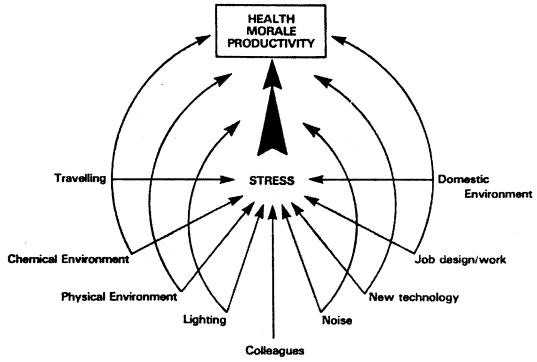

While Bauer *et al.* (1992) maintain psychological variables may play a prominent role in workplace-related disorders like SBS, Kreiss (1989, p. 609) surmises that '… some investigators have misinterpreted the importance of the social dynamics to mean that SBS is only a psychological reaction among the employees'. Research (Mendelson *et al.*, 2000) found significant correlations between psychosocial factors and the number of SBS symptoms reported, and South African research (Bachmann *et al.*, 1995) concurs with this. However, Gunnarsson and Berglund (2002) did not find evidence of this relationship and argue for additional research in this domain. The current research investigates the relationship between several psychosocial variables regarded as playing a role in SBS relative to the number of symptoms reported.

METHOD

Measuring Instrument and Procedure

The 'Office Environmental Quality Survey' (Hedge, 1988) questionnaire was administered, eliciting data on employee perceptions of ambient environmental conditions, environmental factors, occupational factors, work-related health and SBS symptoms. Jobs were grouped into five categories: managerial, professional, technical, clerical and secretarial. Job satisfaction was measured using six items adapted from a short version 'Job Satisfaction Scale' (Brayfield and Rothe, 1955). Job stress was measured using five items adapted from previous studies of self-reported job stress effects (Hedge, 1988).

Data Analysis

SPSS version 8 facilitated analysis of the data. Pearson's product moment correlation analysis was used to ascertain the relationships between psychosocial variables and the number of SBS symptoms in buildings A and B, respectively. *t*-Tests were used to determine differences in the total number of SBS symptoms between buildings A and B, as well as differences in psychosocial characteristics of the sample. Multiple regression analysis determined the best predictors of symptom prevalence for each building.

RESULTS

Table 1 Relationship between psychosocial characteristics and SBS for each building

Variable	Building A		Building B	
	r	*p* value	*R*	*p* value
Job category	0.55	0.02*	0.49	0.03*
Job stress	0.58	0.02*	0.67	0.01*
Job satisfaction	–0.53	0.03*	–0.62	0.01*
Control over environment	–0.17	0.32	–0.28	0.51
Overall environmental satisfaction	–0.53	0.02*	–0.68	0.02*

*$p < 0.05$

Results indicate, there is a significant and direct relationship between job category, job stress and SBS in both buildings (Table 1) ($p < 0.05$). There is also a significant inverse relationship between job satisfaction, overall environmental satisfaction and SBS in both buildings. As the number of symptoms reported increases, there is a corresponding reduction in job satisfaction amongst employees. However, the results indicate there is no significant relationship between control over the environment and SBS in both buildings. Hence, multiple regression analysis was used to determine the best predictors for the total number of symptoms in both buildings.

Table 2:Multiple regression analysis (building A)

Multiple *R*	0.79547			
R Square	0.63277			
Adjusted *R* Square	0.49506			
Standard Error	3.87237			
	F = 53.93, Sig = 0.001**			
Variables in the equation	*B*	SE *B*	*T*	Sig *T*
Job category	0.398	0.342	1.63	0.003**
Job stress	0.135	0.210	0.57	0.002**
Job satisfaction	0.062	0.088	0.23	0.003**
Control over the environment	0.074	0.153	0.17	0.141
Overall environmental satisfaction	0.056	0.733	0.52	0.001**

**$p < 0.01$

Table 3 Multiple regression analysis (building B)

Multiple *R*	0.62467			
R Square	0.54314			
Adjusted *R* Square	0.46315			
Standard Error	3.64356			
	F = 29.39 Sig = 0.001**			
Variables in the equation	*B*	SE *B*	*T*	Sig *T*
Job category	0.111	0.244	3.24	0.001**
Job stress	0.025	0.879	3.69	0.001**
Job satisfaction	0.012	0.733	3.11	0.002**
Control over the environment	0.563	0.683	1.94	0.851
Overall environmental satisfaction	0.009	0.154	2.81	0.001**

**$p < 0.01$

The results shown in Tables 2 and 3 suggest a fairly large percentage of variation in SBS explained by the variables entered in the equation (R^2 = 63.3%, R^2 (adj) = 49.5% (building A), and (R^2 = 54.3%, R^2 (adj) = 46.3% (building B).The F-ratio of 53.93 (p = 0.001) indicates that the regression of psychosocial characteristics on SBS expressed by the adjusted squared multiple R (R^2 = 49.5%) is statistically significant, while for building B the corresponding value was an F-ratio of 29.39 (p = 0.001). Although the models account for a statistically significant proportion of the variability in the number of SBS symptoms reported in both buildings, they only describe approximately 49.5% (building A) and 46.3% (building B) of the variability in the data, suggesting other factors could influence the results obtained.

Table 4 indicates there is a significant difference in the level of job satisfaction, stress and overall environmental satisfaction between employees in buildings A and B ($p < 0.05$).

Table 4 t-Test of the difference in the number of symptoms, level of job satisfaction, job stress, control over the environment and overall environmental satisfaction between employees in buildings A and B.

Number of SBS symptoms	Min	Max	Mean (M)	Standard Deviation (SD)	t-Value	2-Tailed prob.
Building A	1	16	4.000	3.468	–3.81	0.000 **
Building B			7.050	3.546		
Job satisfaction[1]	Min	Max	Mean (M)	Standard Deviation (SD)	t-Value	2-Tailed prob.
Building A	5	30	23.70	6.05	–2.94	0.021*
Building B			14.46	4.24		
Job stress[2]	Min	Max	Mean (M)	Standard Deviation (SD)	t-Value	2-Tailed prob.
Building A	5	25	14.45	1.71	3.20	0.032*
Building B			18.15	3.47		
Control over the environment[3]	Min	Max	Mean (M)	Standard Deviation (SD)	t-Value	2-Tailed prob.
Building A	5	30	28.2	1.24	3.35	0.016*
Building B			25.98	2.43		
Overall environmental satisfaction[4]	Min	Max	Mean (M)	Standard Deviation (SD)	t-Value	2-Tailed probability
Building A	1	5	3.43	1.40	–2.04	0.043*
Building B			2.73	1.43		

*$p < 0.05$
**$p < 0.01$

[1] Where high scores = high satisfaction
[2] Where high scores = high stress
[3] Where high scores = high control over the environment
[4] Where high scores = high overall environmental satisfaction

DISCUSSION

The results obtained in the survey serve to corroborate the findings of previous research demonstrating the direct relationship between job stress and the number of symptoms reported. Moreover, the results obtained suggest an inverse relationship between job satisfaction, control over the environment, overall environmental satisfaction and the number of symptoms reported by building occupants. Respondents in building A experienced lower levels of stress, higher levels of job satisfaction and higher levels of personal control over their environment relative to employees in building B. This lends credence to the view espoused by Heslop (2002) in which it is argued that psychosocial variables may play a part in symptom reporting. Hedge *et al.* (1996) maintain it is possible a worker's level of satisfaction may influence his or her propensity to report symptoms. In their study involving 2829 office employees in 19 buildings, Skov *et al.* (1989) demonstrated that there is a significant relationship between job satisfaction and SBS symptoms. Workers reporting low job satisfaction reported more symptoms, supporting the findings of other studies (Hodgson *et al.*, 1992; Zweers *et al.*, 1992; Sundell, 1994; Menzies *et al.*, 1995). Moreover, the results confirm those obtained earlier (Mendelson, *et al.*, 2000) in which control of environmental conditions was demonstrated to be associated with increased symptom reports. In this context, occupants of building B who perceived lower control over the environment, experienced higher stress and lower job satisfaction and overall environmental satisfaction, reported significantly more symptoms. Moreover, in interpreting the results of this study, however, cognisance needs to be taken of the fact that the majority of respondents were female employees who occupied clerical grade positions and who make use of visual display units (VDUs) for longer periods of time. Indeed, the role of these variables has been explored elsewhere (Heslop, 2002).

The correlations between SBS and psychosocial characteristics underlined the importance of certain factors as independent variables in the explanation of SBS in both buildings. The regression analysis suggests job category, job stress, job satisfaction and overall environmental satisfaction were significant in predicting SBS. Regarding the interpretation of regression coefficients, Kerlinger (1986, p.540) comments as follows: 'Regression coefficients, unfortunately for interpretative purposes, are not stable. They change with different samples and with addition or subtraction of independent variables to the analysis'. Hence, since only psychosocial variables have been investigated in the current research, any conclusions which may arise are somewhat tenuous.

CONCLUSION AND RECOMMENDATIONS

The survey was conducted in buildings in which complaints were prevalent and an investigation was requested and this may have affected symptom reporting. While building B had previously been diagnosed as 'sick', this was not the case with building A. The high prevalence of SBS in both buildings could provide an indication of the gravity of the situation in both buildings. However, an alternative argument in the case of building A is the fact that it (building A) was undergoing refurbishment involving the laying of new carpets, and the painting of the building at the time of the survey, while building B was undergoing no renovations. This is perhaps important in view of

the World Health Organisation's (WHO, 2000) differentiation between 'temporarily sick buildings' where symptoms fluctuate over time, and 'permanently sick buildings' where they persist, despite extensive remedial measures. Hedge *et al.* (1996) maintain that self-reports of symptoms and complaints constitute subjective judgements which can be influenced by both recall and response scale biases. Moreover, a fundamental limitation of the current research project was the fact that no objective assessment of prevailing environmental conditions was conducted. Hence, the subjective responses, that is, perceived indoor air quality, cannot be compared to any findings from an objective indoor environmental assessment.

REFERENCES

Bachmann, M., Turck, W. and Myers, C. (1995). Sick building syndrome symptoms in office workers: a follow up study before and after changing buildings. *Journal of Occupational Medicine* **45** (1), 11–15.

Bauer, R., Greve, K., Besch, E., Schramke, C., Crouch, J., Hicks, A., Ware, M. and Lyles, W. (1992). The role of psychological factors in the report of building-related symptoms in sick building syndrome. *Journal of Consulting and Clinical Psychology* **60**, 213–219.

Brayfield, A. and Rothe, H. (1955). An index of job satisfaction. *Journal of Applied*
Psychology **35**, 307–311.

Brooks, B. and Davis, W. (1992). *Understanding Indoor Air Quality*. Boca Raton: CRC Press

Gunnarsson, A. and Berglund, B. (2002). Psychological factors influencing SBS symptom reporting. *Proceedings of the 9th International Conference on Indoor Air Quality and Climate,* pp. 424–429. Monterey, 30 June–5 July.

Hedge, A. (1988). Job stress, job satisfaction and work-related illness in offices. *Proceedings of the 32nd Annual meeting of the Human Factors Society*, pp. 777–779, Santa Monica: Human Factors Society.

Hedge, A., Erickson, W. and Rubin, G. (1996). Predicting sick building syndrome at the individual and aggregate levels. *Environment International* **22** (1), 3–19.

Heslop, K. (2002). Personal and environmental characteristics, occupational factors and psychosocial correlates of sick building syndrome. *Proceedings of the 9th International Conference on Indoor Air Quality and Climate*. pp. 432–437, Monterey, 30 June–5 July.

Hodgson, M., Muldoon, S., Collopy, P. and Olesen, B. (1992). Sick building syndrome, symptoms, work stress, and environment measures. *IAQ '92: Environments for People*, pp. 47–56, ASHRAE, Atlanta, Georgia.

Kerlinger, F. (1986). *Foundations of Behavioural Research*, 3rd Edition. New York: Holt, Rinehart and Winston.

Kreiss, K. (1989). The epidemiology of building-related complaints and illness. In: Cone, J. and Hodgson, M. (eds), *Occupational Medicine: State of the Art Reviews*, **4** (4), 575–592.

Mendelson, M., Catano, V. and Kelloway, K. (2000). The role of stress and social support in sick building syndrome. *Work and Stress* **14** (2), 137–152.

Morris, L. (1987). SBS and the office environment. *Safety Practitioner* **3**, 4–8.

Skov, P., Valbjorn, O., Pedersen, B, and the Danish Indoor Climate Study Group. (1989). Influence of personal characteristics, job-related factors and psychosocial factors on the sick building syndrome. *Scandinavian Journal of Work, Environment and Health* **15**, 286–296.

Sundell, J. (1994). On the association between building ventilation characteristics, some indoor environmental exposures, some allergic manifestations and subjective symptom reports. *Indoor Air Supplement* **2**, 1–42.

World Health Organization. (2000). *The Right to Healthy Indoor Air*, Bilthoven, Netherlands.

Zweers, T., Preller, L., Brunekreef, B. and Boleij, J. (1992). Relationships between health and indoor climate complaints and building, workplace, job and personal characteristics. *Indoor Air* **3**, 113–116.